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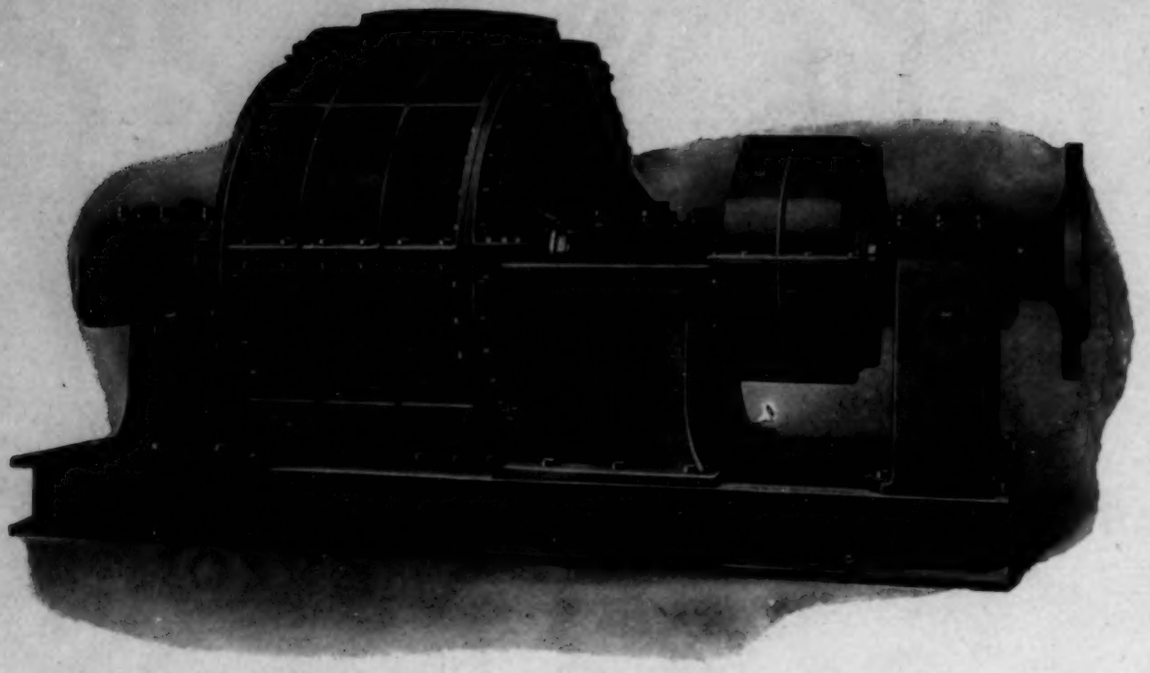

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THE IRON TRADE REVIEW

Vol. LX Cleveland, January 25, 1917 No. 4

Great Tonnages of Steel Plates

Are Inquired for by Domestic and Foreign Ship Builders—Unprecedented Stipulation Connected With Car Buying of French Government

TREMENDOUS demand for plates for export and domestic demand alike continue to constitute a highly important feature of the market. Fully 150,000 tons are now involved in inquiries before eastern makers and mills in the Pittsburgh, Cleveland and other districts are overhelmed with orders. Pending business includes 12,000 tons of plates for Atlantic coast ship yards for six new vessels, another domestic ship yard inquiry for 7,000 tons, and a new inquiry for export is for 30,000 tons of hull and boiler plates. Spanish ship yards are also in the market and Japan is seeking large tonnages. A bridge builder is in the market for 18,000 tons of universal and sheared plates, and for tank construction in the Chicago district, 5,000 tons are needed. Large tonnages for car construction are also pending. Ship builders in Sweden have taken contracts for 18 iron ore vessels on which Swedish iron mining interests recently asked bids from American ship builders. The prices quoted by the Swedish builders were about 25 per cent lower than those named by the American yards.

The latest interesting development in the demand for ships is the appearance of large inquiries from British companies for 20 or more vessels to be built in American yards.

Price Advances

The United States Steel Corporation, effective Tuesday, advanced plates and shapes $3 per ton, making the prices 3.75c per pound, or $75 per ton on plates, and 3.25c per pound, or $65 per ton, on shapes. Steel bars remain unchanged at 3c. The business of the Steel Corporation continues very heavy, but operations are being handicapped by fuel shortage.

Government Buying

In spite of the recent controversies between the navy department and steel manufacturers, some business has been placed. The Carnegie Steel Co. has been awarded from 20,000 to 25,000 tons of plates, shapes and bars for various navy yards on bids recently submitted, which were 3.50c and 3.60c, Pittsburgh, on plates; 3c and 3.10c on shapes and 3c on bars, delivery to be made by the middle of 1918. The American Bridge Co. was the lowest bidder on 5,000 tons for crane runways for the League Island navy yards, Philadelphia, quoting $128 per ton, erected and delivered in 320 days.

Railroad Buying

A new and interesting policy of the French government is disclosed in the announcement that it will be required that the large number of cars for the French steel railways for which inquiries are pending must be shipped in parts, the erecting of the cars to be done under the supervision of American makers by German prisoners of war. This stipulation is likely to delay and possibly prevent the placing of some of this business, but the Standard Steel Car Co. has been awarded 5,000 of the large lot of cars for the French state railways and has closed for the steel required, 30,000 tons. The Alaska Engineering Co. has placed 10,000 tons of rails with the Illinois Steel Co. for the government line in Alaska. The Wheeling & Lake Erie and Michigan Central railroads have closed for 5,000 tons each with the Carnegie Steel Co. The Corporation has booked 4,000 tons for South Africa.

The American Bridge Co. has been awarded 15,600 tons for elevated railroad work in Brooklyn. China is in the market for large quantities of tin plate.

Pig Iron

The pig iron market continues dull, but prices are being well maintained by furnaces, the only concessions being on resale iron sold by brokers. The last of the accumulation of warrant iron purchased at Cleveland about two years ago at around $14, has been sold at $30. Nearly all of the Buffalo warrant iron has also been sold. Some furnaces have taken a decided stand against paying the extremely high prices which have prevailed for prompt furnace coke and in spite of the railroad congestion the prices have been somewhat easier during the past few days on both foundry and furnace grades.

THE OPEN HEARTH

A Humiliating Spectacle

THE spectacle of the secretary of the navy inaugurating the carrying out of extensive plans for the upbuilding of the navy by letting contracts to a foreign country is one of the most humiliating ever witnessed in the history of this country and one of the most deplorable features of the whole miserable business is the method adopted to obtain the bid from Hadfields. Instead of having everything open and above board, the secretary admits that he secretly communicated with the foreign manufacturer. If there had been any excuse for the awarding of the contract to the English firm, it was removed by the way in which the bid was invited.

Mr. Daniels, in the statement which he has issued, pats himself on the back for what he calls "most patient negotiation and appeals to patriotism of the little group of steel manufacturers which has a practical monopoly of this business." The truth is that instead of patiently negotiating with the manufacturers, he has persistently opposed them and refused to give any evidence of being willing to make a reasonable agreement. He calls attention to the fact that the Bethlehem Steel Co. has not made certain shells to meet the requirements of the navy department, and this fact has been freely admitted by the company, as was stated in these columns last week. It was also stated that the company knew of no process of projectile making by which it would be possible to produce in quantities shells which would conform to the navy department's requirements and that in the opinion of President Grace, the requirements of the department on the contracts have been absolutely beyond the development of the art of projectile manufacture. It is by no means certain that the Hadfields shells will stand the test, but even taking for granted that they will, it was the duty of the secretary of the navy to encourage to the utmost the making of shells in this country. If the manufacturers in this country believe that the shells could not be made to meet the navy department specifications, it was the duty of Secretary Daniels and his subordinates to show the Bethlehem and other companies that the shells could be made and insist upon their making them. The idea of leaving this country in a position of dependence upon any nation on earth as to the manufacture of munitions is utterly unthinkable to a truly patriotic man.

If the question were one of price and not of skill, then it ought to be possible for the secretary and the manufacturers to get together, as the officials of the Bethlehem Steel Co., have had a well defined policy of making armor plate at a price to be fixed by the federal trade commission, and have offered to build two battle cruisers at the ascertained cost of building the ships in the government yards, without additional expenses or commissions of any kind, and to contract to have the ships ready for service ahead of the ships built in government yards, it was and is reasonable to suppose that the same broad-minded business policy would be followed in regard to the manufacture of shells. In fact, although it has not been publicly announced, there is reason to believe that the government had ample opportunity of making the contract at a price so fair that there could be no possible complaint about it. It was, however, more agreeable to the secretary to play to the galleries, and that is what he is doing to a disgusting extent.

As is shown by the report of our Washington correspondent, published elsewhere in this issue, conditions relating to the awarding of contracts for battle cruisers are similar to those relating to the shell contracts. The ship building companies have manifested a disposition to be absolutely fair in their dealings with the government, but the secretary of the navy has persistently refused to meet them half way and is clamoring for appropriations to spend millions of dollars more to equip government navy yards so that they can build the four battle cruisers and the three scout cruisers of the 1917 naval program. It is extremely doubtful whether the vessels could be built even after the $12,000,000 had been expended and this fact is recognized by some of the members of the committee who are of the same party as Secretary Daniels.

In spite of the unreasonable attitude of the navy department, we trust that manufacturers will not lose patience, but will do everything in their power to help the government at this time and to show the country beyond all question that they are willing to do their full part and that there is not a particle of evidence to substantiate the charge of lack of patriotism made by Secretary Daniels.

What Ails the Railroads?

WHAT is really the matter with the railroads? is a question that is puzzling a good many people nowadays. Is it shortage of rolling stock, or men, or both; or is it general inefficiency that is responsible for the deplorable conditions existing today?

Of course, the railroads could use a great many more cars if they had efficient men to handle them, but in the opinion of competent observers efficiency of many employes has deteriorated at least to the extent of the advance in wages and many of the most desirable employes have been attracted to other pursuits by higher wages than the railroads are paying.

THE OPEN HEARTH

There seems also to be physical exhaustion and a breaking down of spirit due to the long and unprecedentedly severe strain to which railroad employes have been subjected. After all, questions relating to men are fully as important as those relating to equipment in the railroad situation.

What is the remedy? Cars and equipment will, of course, be available in sufficient numbers in the course of time, but the human factor is more uncertain. No one can tell what the supply of labor will be after the war has ended, but employes should remember one thing: a day of reckoning is coming. The laggards of today will be remembered in coming years, when the demand for men will not be such as it is today. So will the faithful workers be remembered. The man who gives to his job the very best that is in him will not fail to receive his reward when some day—no one can tell exactly when—a period of depression again prevails in this land, a time when there will be more men than jobs.

Regardless of opinions as to the President's latest international peace proposal, two things are certain: The message deserves serious consideration, and such consideration must be free from partisanship.

Co-operation Imperatively Demanded

THE report of the board appointed to investigate the advisability of manufacturing munitions of war exclusively in government plants, referred to in *The Iron Trade Review* of Jan. 11 and published more fully in today's issue, is noteworthy on account of the vast amount of information it contains and for numerous sound conclusions. Issued at a time when the secretary of the navy is antagonizing manufacturers as has never before been done in the history of the country, the report comes as near being a rebuke for that official as a report of such a board could be expected to be.

In discussing the comparative cost of munitions manufactured by the government and by private concerns, the report shows very clearly why the figures claimed as costs for government products cannot in fairness be compared with the costs of private manufacturing companies. It may be seriously doubted, however, whether, after giving the government all the advantages mentioned by the board, the products do not actually cost the people more than if they were turned out by private individuals or companies.

The board does not hesitate to use very plain language in speaking of the peril which confronts this country, for it says that "no student of our present condition can fail to see that we are far indeed from that degree of preparation which could protect us from at least temporary defeat and disaster at the hands of any enemy which might overcome our navy." Taking up the question of the probable cost of supplying arms, ammunition and equipment exclusively through government plants, the board shows that while it is not possible to give more than an approximate estimate, it is certain that the expenditure would be enormous. Perhaps the board did not consider it within its province to point out how rapidly expenditures of the government are piling up and how even without going into a greater extent into the building of government plants, it will be necessary for congress to resort to extraordinary methods to raise revenue. Nor perhaps could the board with propriety point out how congress is spending money like a drunken sailor on public buildings and in many ways, but the people of the country have the right to consider all these manifestations of recklessness and extravagance in connection with the admirable report which the board has made.

One of the most important chapters of the report relates to the duty of manufacturers toward the government and shows how unjust are insinuations by public officials that manufacturers are unwilling to co-operate with the government, or, if they do so, are actuated by sordid motives. The board declares that the private manufacturers are more than willing to co-operate and it adds that they "are anxious to do so, fully realizing that in successful co-operation with the government lies the best, if not the only, certain chance of success."

The board then proceeds to tear to pieces the claim that the giving of contracts to private concerns might result in building up a powerful war class, who, on account of possible profits resulting from war, might become a danger to the state. The board is not at all alarmed by any such bogie man and points out that in all likelihood the government in time of war would so control the plants manufacturing munitions that there would be little, if any, profit for the manufacturers.

Finally, the board shows it is imperative that action be taken promptly in regard to co-operation of the government and private manufacturers. If that is not done, much of the special equipment which has been installed in many plants to fill orders from Europe will go to the scrap pile and in many other ways any plan of co-operation would be made difficult.

The time for action is now. The action should be prompt, hearty and intelligent. We are not yet ready to believe that all the men in Washington are of the Daniels type. We are hopeful that some officials will have the courage to insist upon the adoption of just the kind of co-operation which the best interests of the country imperatively demand.

Prices Present and Past

(Yesterday, a month ago, three months ago and a year ago.)

Quotations on leading products January 24, average for December, 1916, average for October, 1916, and average for January, 1916. Prices are those ruling in the largest percentage of sales at the dates named.

	Prices Jan. 24, 1917.	Aver. for Dec., 1916.	Aver. for Oct., 1916.	Aver. for Jan., 1916.
Bessemer pig iron, Pittsburgh...	$35.95	$35.95	$24.325	$21.32
Basic pig iron, Pittsburgh.....	30.95	30.95	20.825	19.20
No. 2 Fdy. pig iron, Pittsburgh	32.95	31.70	21.075	19.95
Northern No. 2 Fdy., Chicago..	31.00	29.25	19.15	18.50
Lake Superior Charcoal, Chicago	33.75	32.00	20.40	19.25
Malleable, Chicago	31.00	29.25	19.50	19.00
Southern No. 2, Birmingham...	23.00	23.00	15.13	14.50
Southern Ohio No. 2, Ironton...	30.00	30.00	19.38	18.00
Basic, eastern Pa.....	30.50	30.00	21.00	19.50
No. 2X Virginia furnace.....	27.50	26.00	18.50	17.25
No. 2X foundry, Philadelphia...	30.50	29.50	20.50	19.75
Ferro mang., furnace.....	175.00	160.00*	160.00*	110.00*
Bessemer billets, Pbgh.....	62.50	58.75	45.75	33.75
Bess. sheet bars, Pbgh.....	62.50	58.75	45.75	33.75
Op.-h'th sh. bars, Pbgh.....	62.50	58.75	45.75	34.75
Open-hearth billets, Pbgh.....	62.50	58.75	45.75	34.75
Steel bars, Pittsburgh contract...	3.00	2.925	2.60	1.86
Steel bars, Chgo.....	3.19	3.10	2.80	2.03
Iron bars, Philadelphia.....	3.159	3.059	2.659	2.259
Iron bars, Cleveland, local del'y.	3.00	3.00	2.55	2.00

*Tidewater.

	Prices Jan. 24, 1917.	Aver. for Dec., 1916.	Aver. for Oct., 1916.	Aver. for Jan., 1916.
Iron bars, Chgo mill.....	$3.00	$2.85	$2.35	$1.83
Beams, Chgo. contr.....	3.29	3.20	2.80	2.03
Beams, Pittsburgh, contr.....	3.10	3.025	2.70	1.86
Beams, Philadelphia	3.409	3.409	2.859	2.159
Tank plates, Pbgh., contract.....	3.60	3.525	3.00	1.87
Tank plates, Chicago, contract...	3.79	3.75	3.19	2.05
Tank plates, Philadelphia.....	4.659	4.159	3.909	2.409
Sheets, blk., No. 28, Pbgh.....	5.00	4.50	3.225	2.58
Sheets, blue anl., No. 10, Pbgh..	4.50	4.00	3.125	2.45
Sheets, galv., No. 28, Pbgh.....	7.00	6.25	4.45	4.75
Wire nails, Pittsburgh.....	3.00	3.00	2.62	2.12
Connellsville fur. coke, contr...	8.00	4.44	3.37	2.38
Connellsville fdy. coke, contr...	6.50	6.00	4.87	3.75
Heavy melting steel, Pbgh.....	22.00	25.00	17.87	17.50
Heavy melting steel, eastern Pa.	21.00	24.00	15.75	16.75
Heavy melting steel, Chgo.....	20.56	23.37	16.50	15.50
No. 1 wrought eastern Pa.....	27.00	27.00	22.00	22.25
No. 1 wrought, Chgo.....	23.00	25.37	17.50	15.50
Rerolling rails, Chgo.....	27.00	29.50	18.75	17.70
Car wheels, Chgo.....	18.25	21.87	12.25	14.75

(For Additional Prices See Page 288.)

Delivery of Pig Paramount Question

Railroad Embargoes Interfere With Movement of Tonnage— Extremely High Ocean Freight Rates Curtail Foreign Business

New York, Jan. 23.—Problems of delivery still are uppermost in the pig iron market and new buying is almost at a standstill. Most domestic buyers are keeping after the furnaces for their shipments and a number of the latter are considerably behind. Between the scarcity of freight room and the prohibitive vessel rates on one side and the embargoes of the railroads against the receipt of new shipments at tidewater, very little new export business is being done, although the inquiry continues promising. The effect of the operations of the German raiders has been to make ocean shipments more uncertain. The French government's negotiation for round blocks of bessemer are going forward and there are reports, as yet unconfirmed, that some important purchases have been closed in the east. In some cases, deliveries throughout the present year are being arranged for. The talk of sellers is for a minimum of $35, valley, or $37.14, tidewater, on standard bessemer. A resale lot of 3,000 tons has been offered at $33.50, valley, but this is thought to be exceptional. One prominent valley interest has been asking $36, furnace. Some new foreign inquiries are current, including one for 4,000 tons of low phosphorus, on which the destination is not given. Domestic business is a matter of small tonnages. The government has asked for 2,100 tons of foundry charcoal and low phosphorus for nearby delivery to navy yards at Brooklyn and Norfolk. A copper company inquired for 750 tons of Alabama iron for delivery in the southwest. About 2,000 tons of miscellaneous foundry inquiry are current. Prices in eastern and central Pennsylvania are from $30 to $32 for No. 2X.

Alabama warrants are easier, as there is considerable tonnage to be had and bids are able to develop lower prices. Some No. 2 spot warrant iron is obtainable at $22, Birmingham, and perhaps lower. A small sale this week was at $22.50.

Deliveries Still Difficult

Philadelphia, Jan. 22.—A modest expansion in nearby buying of pig iron is shown as the factor of delivery continues uppermost in the minds of both producers and consumers in eastern Pennsylvania and surrounding territory. Operators have been assuring greater regularity, but are still below normal. The furnaces are bending their efforts to get out their current deliveries and are meeting with difficulties. Except in low phosphorus, where buyers are pressing for any position they can get, there is little new forward demand. A Canadian buyer closed with an eastern maker for 2,000 tons of standard low phosphorus for delivery beginning in May and extending through the year. About 5,000 tons for Canada are pending. Practically all the leading eastern users of low phosphorus are short on early iron and continue vigorously to keep after the furnaces. The troubles of these consumers have been added to because embargoes at Chicago are preventing them from getting iron purchased in the Milwaukee district.

Standard low phosphorus is quoted at $55 to $57, Philadelphia, or $53 to $55, furnace, with little offering. On 1,000 tons for Italy, $51, furnace, was refused. Another 500-ton sale of Lebanon low phosphorus, March delivery, for export, at $55, furnace, is noted. The Pennsylvania railroad,

(*For complete prices see page* 288.)

which last week was seeking high manganese iron for early shipment, now is closing on 1,000 tons of low silicon for quick delivery. Small prompt sales of foundry have been more numerous. A 100-ton lot of standard mill forge brought $32, eastern Pennsylvania furnace. Some makers now are asking this price for any grade. A Philadelphia buyer asked 500 tons of prompt malleable and received only one quotation. Basic is unsought. In Virginia a 5,000-ton resale black, which has been offered at concessions for several weeks, now has been absorbed, the last several thousand tons going at $24 and $24.50, furnace. The market now is firmer. One Virginia maker, who has been out of the market, now is quoting $27.75, furnace, for No. 2X, and $27.50 for No. 2 plain for last half. Some Alabama warrants are being offered below furnace prices. A price of $22.25 was asked for 500 tons of No. 2 soft.

Valley Market Quiet

Pittsburgh, Jan. 23.—The pig iron market in the valleys continues quiet. Except for about the usual number of inquiries for export or for early shipment to domestic consumers, affected by railroad embargoes and congested traffic conditions, scarcely any activity is noted. Tentative inquiries are pending for approximately 50,000 tons of bessemer iron for shipment to France, and fairly heavy demand exists for delivery to England. Scattering tonnages of steelmaking and foundry grades are being sold for spot shipment to domestic consumers, at current prices. A week ago, as previously reported in these columns, an eastern seller offered 3,000 tons of bessemer iron on the basis of $33.50, valley; it is understood that this is resale iron, to be shipped from a southern Ohio furnace. The offering of this tonnage has in no way affected generally prevailing prices. The Carnegie Steel Co. is operating 43 of its 59 blast furnaces; 10 furnaces are banked on account of the slow movement of coke and six are out for repairs. Last night, the company banked six furnaces at the Edgar Thomson Works, when the waters of the Monongahela river threatened to overflow its banks. These furnaces are blowing again today.

Prices Firm—Sales Small

Buffalo, Jan. 23.—The sales made by the furnaces of the Buffalo district in the past week have been very small owing to the fact that the producing interests here have been and apparently will continue to be out of the market for some time. About the only iron obtainable through the local producing interests is small lots secured by the furnace interests from producers in other sections, as previously reported. Where Buffalo iron is obtainable in odd lots for early shipment the price, irrespective of grade, continues to hold to $35 at the furnace. A few sales of carload lots or so of higher grades have been made at $36.50 and the price has been shaded slightly below $35 on a few minor lots of gray forge, but not enough sales are being closed to establish a schedule with grade differentials or to vary much from the flat price that has prevailed now for a number of weeks.

The sold-up condition of the furnaces has caused the Buffalo market to quiet down, although the inquiry of the past week, while reported light, has shown a leaning toward increasing interest on the part of the buyers.

A little re-sale iron is in the market for prompt shipment, but the tonnage, once a factor as a possible source of urgent supply, has been reduced close to the vanishing point.

Warrant Iron Disappears

Cleveland, Jan. 23.—The last of an accumulation of Cleveland warrant iron was disposed of a few days ago when a sale was made of low silicon iron, about No. 3 grade, at $50. This iron was purchased about two years ago at around $14. There was also a considerable accumulation of basic warrant iron, but that was disposed of some time ago. The pig iron market is not active, but prices are firm and no furnace is quoting bessemer at less than $35. Foundry iron has been sold by a lake furnace as high as $31.50, furnace, for shipment into eastern territory, taking freight rates from $2.30 to nearly $3 per ton. A sale of malleable has been made by a lake furnace for prompt delivery at $32.

Lagging at Cincinnati

Cincinnati, Jan. 23.—A Dayton, O., user has taken 650 tons of mixed grades of foundry iron for first half delivery. This is the only sale of importance made in this market in the past week. The price of pig iron has fluctuated a little in the past few days. One southern stack offered to take a little business at $22.50, Birmingham basis, for No. 2 foundry iron for the last half of the year, but today has gone back to the old basis of $23, for the same delivery. The majority of southern stacks hold at $25, for any delivery during 1917. Southern Ohio No. 2 foundry iron can be had only for the last half at $30, Ironton basis.

Inquiry More Active

St. Louis, Jan. 22.—The pig iron industry has picked up considerably in this locality, and more inquiries are before the market than have appeared for some time. Aside from car lot inquiries, there are in the market, one for 1,000 tons of southern No. 2 for last half delivery, 1,000 tons of northern No. 2 for second and third quarter delivery, 300 tons of southern No. 2 for second half delivery, and one for 300 tons of northern No. 1 for delivery immediately.

Southern No. 2 is quoted all the way from $22 to $25 a ton, while northern iron is held at $30, Chicago and Ironton.

Sales last week included 6,500 tons of high silicon for last half delivery, and 300 tons of Lake Superior charcoal iron, besides quite a number of car lots for prompt delivery.

Chicago Demand Slackens

Chicago, Jan. 23.—Pig iron buyers show little interest in the market for northern or southern grades. Inquiry is small and sales make a small tonnage.

A sewing machine manufacturer in northern Illinois recently bought 2,000 tons of southern iron for second half. This is the only exception to the general dullness. The inquiry asked iron with silicon from 2.50 to 4.50 in various tonnages. A portion of the iron is said to have been sold at $26, delivered, the equivalent of $22, Birmingham. The remainder is said to have commanded a slightly higher price with usual premiums for silicon.

Northern iron is quoted at $31, fur-

(For complete prices see page 288.)

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nace, with occasional tonnages bringing a slightly higher price. A few melters find a need for additional iron and are taking small tonnages for prompt delivery. Ferro-manganese of local manufacture is being quoted at $175 to $185 with strong demand.

Southern iron is being quoted at $23 to $25, Birmingham, but comparatively little new business is being placed. Sales of prompt delivery iron are less, as the supply of resale iron seems to be nearly exhausted.

Expectation of labor trouble in the spring is having some effect and malleable melters especially fear their output the first half of the year will be cut down from this cause. A part of their first half iron may be left over for use during second half.

Showing Renewed Interest

Birmingham, Ala., Jan. 23.—Pig iron selling and an active inquiry as to iron for first or second half of year delivery brings back activity in the southern market and manufacturers are again interested. The lull that prevailed just before and after the holiday season is rapidly passing away and those companies in position to sell the product with guaranteed delivery within the near future are booking business again. The Alabama Co. has booked an order for several hundred tons of iron for shipment to Scandinavia at $25 per ton above the regular market quotations, $24 per ton, No. 2 foundry and basic. The Sloss-Sheffield Steel & Iron Co., with six blast iron furnaces in operation, last week sold more iron than was produced and started off this week well, that company holding firmly to a minimum of $24 per ton. The Woodward Iron Co. has orders in hand that will require full production at its four furnaces while the Republic Iron & Steel Co. is keeping its three blast furnaces going in this district on full time. The Anniston Operating Co., the Alabama Co. and other ironmakers are keeping their producers at maximum pace. Export business is again being offered. Sales agents are being assured that peace proposals in the European war zone are no further to be considered and that there will be need for additional metal.

Prediction is made in the southern territory that pig iron quotations will advance 50 cents or more per ton within the next 30 days, if that long off. Car shortage is causing some uneasiness in getting metal to seaboard to meet vessels about to arrive and take on cargo for foreign ports. As a consequence, traffic representatives of iron companies are extremely busy with higher officials of the railroads. Domestic and home consumers are in need of iron for this year's melt yet, and indirectly are making inquiries as to their probable need.

Ferro Still Gains

And Spiegeleisen Joins in the Upward Price Movement

New York, Jan. 23.—Spiegeleisen has joined in the stronger movement recently shown in ferro-manganese and sales of this alloy have been made at higher prices. A buyer in the Pittsburgh district bought several hundred tons for second quarter at higher than $60, furnace, for 20 per cent. For export, for which several inquiries of 500 to 1,000 tons each, chiefly for Italy, are pending at $65, tidewater, a price equivalent to about $63.50, eastern furnace, has been named to middlemen. A leading eastern steel company is understood to have bought 5,000 tons of domestic spiegeleisen for an extended period, shipment to begin at an early date at a reported price of $57, delivered. Several other sales have been named. One producer recently has disposed of from 3,000 to 4,000 tons, largely for shipment by July on a rising scale of prices. The last sales were at $58, furnace, but higher now is wanted. An Ohio river consumer is inquiring for 400 to 600 tons.

Ferro-manganese continues gradually to acquire greater strength under a fair inquiry for early delivery, chiefly in small lots. A southern steelmaker wants 400 tons. Some of the domestic makers are unable to make shipments so promptly. One of them has nothing to offer before March or April and has quoted $185, furnace, for that delivery. Some sales of domestic 75 per cent metal have been made at $175, delivered. English ferro-manganese, which is only offered for forward delivery, remains at $164, seaboard. The foreign producers are not shipping as much at present as a month or two ago and some of them are farther behind in their deliveries. One maker has made no shipments of consequence for several months.

The situation in 50 per cent ferro-silicon reflects no improvement and early supplies are practically unobtainable at any price. There are buyers in the market who would pay $150, Pittsburgh, for spot lots, or $50 over the nominal schedule of makers, but little metal can be obtained even at this figure. For the moment, the market is being determined by how badly prompt material is needed and by how much the consumer will offer for it.

(*For complete prices see page* 288.)

Alloys Rise in Price

Pittsburgh, Jan. 23.—Prices of all kinds of ferro alloys and steelmaking metals are hardening. Eighty per cent ferro-manganese, which had been offered freely at $164 to $175 a ton, now is being held at $185 a ton at the seaboard and domestic furnace. Fairly heavy tonnages of this material have been sold recently at $175, furnace. Fifty per cent ferro-silicon, which had been nominally listed at $90 to $100 a ton for many months, has commanded as high as $190 a ton at the furnace this week. It is not believed this material can be obtained at less than $175 a ton.

Tin Plate Demand

Is Heavy for Export, but Mills Can Not Book Tonnage

Pittsburgh, Jan. 23.—No change is noted in the situation for tin plate. Manufacturers have not opened books for delivery in the second half of the year and scarcely any tonnage is being sold for shipment before July 1. Heavy demand exists for export, but mills in this territory are unable to entertain additional negotiations on account of their inability to meet specifications for delivery. Tin plate nominally is quoted at $7.50 to $8 per base box.

Will Make Spiegel

New York, Jan. 22.—Manufacture of spiegeleisen is to be inaugurated about Feb. 1 by the Seaboard Steel & Manganese Corporation, 11 Pine stret, New York, at its Temple furnace, Temple, Pa. Various grades of spiegeleisen are to be produced. Later the manufacture of ferro-manganese may be undertaken. The Seaboard Steel & Manganese Corporation controls manganese ore deposits in Virginia at Elkton and at other points. The Temple furnace has been operating on foundry iron for which it has a capacity of about 150 tons daily. The furnace is equipped with three McClure 3-pass stoves, 17 x 83 feet. Frank Samuel, Philadelphia, has been made agent for the sale of the company's production of spiegeleisen.

New Power Company

The Acme Power Co., with a capital of $25,000, has been incorporated by F. J. Derge, C. E. Murray and M C. Seeley. The company will have charge of the erection of the Toledo Railways & Light Co.'s plant on the East Side.

Buying of Bars

Proceeds Very Quietly—Implement Makers' Requirements

Philadelphia, Jan. 22.—Only miscellaneous buying of steel bars is being done and there continues to be some spread in the prices quoted by various makers as well as in those which different consumers will accept. A sale of about 500 tons for second quarter was made in this territory at 3.50c, Pittsburgh, or 3.659c, delivered. Other buyers have declined to close on quotations of 3.75c, Pittsburgh, for second quarter. Some of the jobbers are insisting they must have much lower prices. The Carnegie Steel Co. has been awarded the order for 2,000 to 3,000 tons for the various navy yards at 3c, Pittsburgh, but for delivery extending far into 1918. A number of buyers have yet to close for the second quarter, but have not appeared in the market. Implement manufacturers have been specifying freely, as some mills have been urging them to have anticipated their needs. An independent maker, who has been selling freely for comparatively early shipment, now has his mills filled for 90 days.

Bars Held at 3 Cents

Pittsburgh, Jan. 23.—Steel bars for shipment at the convenience of the maker continue to be held at 3c. Some mills have been selling rather heavy tonnages at that figure for shipment in the second half of the year. Several manufacturers of farm machinery are reported to have figured in the market recently, but mills at this center deny having taken contracts to furnish any of this tonnage. Specifications against contracts have not fallen off, and rather heavy new demand exists.

Railroad Situation Worse

Buffalo, Jan. 23.—Order books of mills and agencies have been opened in some instances in the past week for contracts covering second quarter needs. The sellers in most cases, however, are requiring the consumer to specify as to sizes and tonnages needed instead of booking orders on a general contract basis. The severe weather, lack of cars, labor and fuel have caused the railroad situation, as far as Buffalo shipping is concerned, to become worse in the past week, instead of better. The railroads are inclined to the belief that relief will not be material for a number of weeks to come.

Buy Quietly

Cleveland, Jan. 23.—Nearly all of the agricultural implement manufacturers in this district contracted for last half, most all of them having placed their business when leading companies were quoting 2.90c, Pittsburgh. The business was done in a very quiet way following the closing of considerable business at Chicago.

Steel Bars Pegged

Chicago, Jan. 23.—With the leading interest sold fully for the present year and important independent steel makers not yet willing to complete booking their second half output, the steel bar market stands nominally at 3.19c, Chicago mill. Both makers and consumers seem satisfied with conditions, as most regular customers of mills already have covered their necessities for the year as far as conditions will permit. Specifications on previous contracts are being made steadily and in large volume. Consumers are anxious to obtain as much material as possible at an early date and this has the effect of bringing in specifications promptly, to gain as good position as possible on rolling schedules.

Hard steel bars continue firm at 3c to 3.10c, Chicago mill, with good demand and a decidedly easier situation as to rerolling rails, which were unusually scarce and costly a few weeks ago.

Bar Iron Quiet

Chicago, Jan. 23.—The market for bar iron is without feature, the quotation remaining firm at 3c, Chicago mill, and comparatively little business being booked. Occasionally a regular consumer inquires for an additional tonnage and there is considerable demand from outside consumers who ordinarily use steel. Mills are not anxious to sell much iron at present in the face of heavy bookings and the market is comparatively quiet.

Shafting Hardening

Pittsburgh, Jan. 23.—The 20 per cent off the list price now is being enjoyed only by the more important consumers of cold rolled steel shafting. Some mills are refusing to shade 15 per cent off the list, and as high as 10 per cent off the list is being asked in many instances. Deliveries are described as more satisfactory.

Hoops and Bands Premiums

Pittsburgh, Jan. 23.—The Carnegie Steel Co. continues to offer hoops at 3.50c and bands at 3c, but cannot fill additional obligations until the third quarter of the year. Some manufacturers are selling these products for second quarter shipment at $5 and $10 a ton above prices for delivery at the convenience of the maker. New demand is described as heavy, and specifications have not fallen off.

(For complete prices see page 288.)

High Waters

Threaten to do Much Damage, But Are Now Receding

Pittsburgh, Jan. 23.—Manufacturers of iron, steel and allied commodities operating plants along the rivers and streams in western Pennsylvania and eastern Ohio, gave a huge sigh of relief this morning when the weather bureau announced that the waters of Allegheny and Monongahela rivers had reached their crest at the point where they form the Ohio river. Heavy rains on Sunday, augmented by melting snow on the watersheds of the three rivers placed them at a flood stage last night and a 22-foot stage was reached at the Point bridge shortly before 6 o'clock. The rivers continued to rise until about 5 o'clock this morning, when a 25.2 stage was recorded. The waters have been receding at the rate of about 6 inches an hour since 5 o'clock this morning.

Turtle Creek overflowed its banks yesterday in the East Pittsburgh district and interfered with work in several shops of the Westinghouse Electric & Mfg. Co. The McKeesport Tin Plate Co. suspended operations at its tin mill near McKeesport last evening, on account of the high waters. Managers of many other mills made preparations to cease operations this morning. The Carnegie Steel Co. banked six of its blast furnaces at the Edgar Thomson Works last night, but is blowing all of these stacks today.

Strip Steel Firm

Pittsburgh, Jan. 23.—Cold rolled strip steel is being held at 7c, base, for future delivery. For early shipment, some mills are selling material at as high as 11 cents. Manufacturers have not opened books formally for shipment in the second quarter of the year, although they will not be able to fill their present obligations until May or June.

Nuts, Bolts and Rivets

Pittsburgh, Jan. 23.—An early advance in the price of nuts, bolts and rivets is predicted by manufacturers in this district. Specifications against contracts continue heavy and new demand is active.

The Pembroke Machining Co., Ltd., Pembroke, Ont., has been incorporated to operate foundries, machine shops, etc., to manufacture machinery, munitions, tools, etc., with $100,000 capital stock, by Edward A. Dunlop, James F. Munn, Charles A. Eaton and others.

Plates, Plates, More Plates

Is the Cry from Home and Abroad—Inquiries for Fully 150,000 Tons Now Pending in Eastern Mills

Philadelphia, Jan. 22.—A figure of 150,000 tons probably would not represent the aggregate quantity of plates called for by inquiries now pending before eastern makers. Atlantic coast ship yards within a few days have asked for the plates for six ships calling for about 12,000 tons of plates. Another domestic ship yard inquiry for 7,000 tons for the last quarter of this year also is out, and the 6,000 to 8,000 tons for the Sun Ship Building Co., for 1918, remains open. Eastern makers are reluctant to quote on ship steel for 1918 at this time. A new export inquiry asks for more than 30,000 tons of hull and boiler plates for 1918 shipment. Spanish ship yards are in the market for an indefinite tonnage. Japan continues to negotiate freely. A Philadelphia broker has asked for 10,000 tons of ship steel for export. There are large inquiries current also for ordinary tank and structural plates. One bridge builder wants 18,000 tons of universal and sheared plates and a quantity of lighter steel. A 50,000-ton export inquiry from British sources still is open, but is active. For tank construction for packing interests in the Chicago district, 5,000 tons are wanted. Some large car steel tonnages are pending. Ship plates, Lloyds specifications, are held by eastern mills at 6c, Pittsburgh, as minimum. Domestic yards are fighting against paying such prices. One maker was obliged to decline to figure on export business where the prices talked for hull steel were 6.25c and 6.50c, Pittsburgh, because he could not make the deliveries. Straight tank plates are quoted at 4.75c to 5c, Pittsburgh. A western mill sold 400 tons for early shipment to a buyer in this district at 4.50c, Pittsburgh, or 4.659c, Philadelphia. The Carnegie Steel Co. has been awarded 10,000 to 15,000 tons of plates for stock for the different navy yards at its bid of 3.50c to 3.60c, Pittsburgh, and on a promise of delivery by midyear, 1918. One important eastern mill reports some falling off of plate specifications this week, but this appears to be exceptional.

Plate Mills Hampered

Pittsburgh, Jan. 23.—Owners of rolling mills are directing their attention to the production and shipment of material, forgetting, for the time being, all about new orders. Congested traffic conditions in all sections of the country seriously are interfering with the output of iron, steel and allied commodities. Heavy tonnages of semi-finished and finished steel products are being piled by manufacturers on account of the car shortage and the lack of necessary motive power. Railroad officials continue to promise early relief, but traffic managers of steel companies declare they can see no change in the general situation.

Specifications against contracts for finished steel continue to run ahead of mill capacity, according to several steel company officials. At least one of the larger mills in this district has more unspecified tonnage on hand today than ever before in its history. Steel plates are quoted at 3.60c by the Carnegie Steel Co. for delivery at its convenience.

Cleveland Mills Filled

Cleveland, Jan. 23.—Plate manufacturers in this district report that they have more orders on their books than ever before, and are taking business now in a very conservative way, the usual quotations being 5c, Pittsburgh. In one transaction, plates were sold at 4.50c from a warehouse outside of Cleveland, although mill quotations varied from 5c to 5.50c. A great deal of trouble is being experienced in getting deliveries. In some cases, cars have been lost temporarily.

Plates Command Premium

Chicago, Jan. 23.—With an insatiable demand for steel plates from car and ship builders and other consumers, mills could contract for their output almost indefinitely. The leading interest is willing to take future contracts at the present nominal quotation of 3.79c, Chicago mill, on definite projects with delivery probably 15 to 18 months hence. This is not being done to any great extent, as the time of delivery is too remote.

An independent steel maker recently sold a tonnage of commercial plates for first quarter delivery at 4.69c, Chicago mill. These plates do not require inspection and the maker is not held to specifications as to analysis.

(*For complete prices see page 288.*)

Underbid by Swedish Shipbuilders

New York, Jan. 23.—An inquiry for a large fleet of iron ore vessels which prominent Swedish mining interests recently had before American ship builders, has been satisfied by the placing of contracts by these interests with their home yards for 18 carriers. These boats are to be from 8,000 to 9,000 tons dead weight capacity each and some of them will be used in the carrying of iron ore between Sweden and the United States. It is understood that the prices quoted by the Swedish builders were about 25 per cent under those named by the American yards.

Ore Contract

Made for Carrying 400,000 Tons from Head of Lakes

Cleveland, Jan. 23.—The evidence that vessel interests held out a considerable part of their capacity when contracts for carrying ore for this year were made some weeks ago was furnished today when a contract was made for carrying 400,000 tons of ore at $1, net, from the head of the lakes, where it will be loaded for delivery at Ohio ports. It is understood that the contract was made with a large shipper after small shippers, who could not guarantee dispatch, had offered $1.25.

Swedish Ore Shipments

New York, Jan. 23.—Swedish iron ore shipments to eastern furnaces during 1916 were approximately 300,000 tons, which is about the same amount annually for several years. These imports were the largest originating in transatlantic sources. Vessels bringing in this ore are returning with coal for the Swedish government, as the latter owns a considerable interest in these boats. A new contract for about 100,000 tons of coal recently has been closed and will be taken on by these boats at Philadelphia.

Will Make High Silicon Iron

The Milton Iron Co.'s furnace at Wellston, O., the principal owners of which are H. S. Willard Sr. and H. S. Willard Jr., is expected to go into blast about Jan. 29.

The Milton furnace was formerly a part of a group of three furnaces owned by the Wellston, Steel & Iron Co., but was recently taken over and will be run under the old original name and operated by the original people owning Milton. The furnace will produce high silicon foundry iron. The Domhoff & Joyce Co., with offices at Cincinnati, Cleveland, Indianapolis, Chicago and St. Louis, have been appointed exclusive sales agents.

Sheet Prices

Are Very High, but Show a Considerable Variation

Youngstown, O., Jan. 24.—Somebody in the latter part of last year compared the sheet market with a skyrocket. But he will have to construct a new simile or allege that it is possible for a skyrocket to defy gravitation. For the skyrocket as yet shows no signs of coming down. It has not ascended since before the holidays, but it has held itself up, and shows no immediate sign of turning nose downward.

Here is a general average of quotations in the Mahoning valley: Black sheets, 5c to 5.50c; blue annealed, 4.50c to 5c; galvanized, 6.50c to 7c. There are a few quotations on either side, but these figures represent a fair expression of the market. One concern is quoting 4.75c for black sheets, but there are a few quotations a little higher than 7c for galvanized; so the whole averages up.

Inquiries, both domestic and foreign, are reported to be so strong that the sheetmakers take only such business as is most convenient.

The freight situation is a little better as to incoming shipments of raw materials, enabling a higher degree of production, but cars for shipments to customers still are woefully scarce.

Blue Annealed Scarce

Philadelphia, Jan. 22.—Blue annealed sheets have become scarce with eastern makers and only odd lots are obtainable for nearby shipment. Selling has continued active, and eastern makers now are booked well into the third quarter. Prices quoted are from 4.50c to 5c, Pittsburgh, the top figure applying to small quantities for early delivery. The Pennsylvania railroad and some of the car builders have been placing orders for coach construction.

Prices Unchanged, but Stronger

Pittsburgh, Jan. 23.—Prices of steel sheet products in western Pennsylvania show no important change this week. However, quotations appear to be hardening all along the line, and it is not unlikely that minimum figures will disappear before the end of this month. Virtually every manufacturer of sheets in the Greater Pittsburgh district has enough actual tonnage on his books to maintain present operating schedules until July 1; for this reason scarcely any tonnage is being offered for shipment the first half of the year. Since mill managers show no disposition to sell for delivery in the third or fourth quarters of 1917, the market is comparatively quiet. Blue annealed sheets are selling at 4.25c to 4.75c, for No. 10 gage; several mills are refusing to shade 4.50c. No. 28 gage black steel sheets are being offered at a range from 4.50c to 5.50c in this district; tin mill sizes are selling at a similar range in quotations. Coated sheets continue to be offered at 6.50c to 7.50c, base. About 45 per cent of the galvanizing capacity of the sheet mills is engaged. None of the mills in this territory has opened books for shipment after July 1. Some of the heaviest consumers of sheets, including the automobile makers, electrical equipment manufacturers and builders of farm machinery are manifesting interest in the market for shipment the second half; some of these interests have been able to make reservations, at prices to be determined later.

Sheets Go Higher

Chicago, Jan. 23.—Steel sheets offer little feature except the steady advance in prices, to which there seems no end. No. 28 gage black are now quoted at 4.69c to 4.94c, Chicago, with No. 10 gage blue annealed at 4.44c to 4.94c, Chicago mill. Differentials from the base gage have been altered so materially during the present boom period that the schedule is more or less irregular and prices do not follow the usual rule.

No. 28 gage galvanized are quoted at 6.50c to 6.75c, Chicago.

Index is Ready

The index to Volume LIX of The Iron Trade Review, being for the period from July 1 to Dec. 31, 1916, has been printed and is ready for circulation. It will be sent as in past years to those who are on the mailing list for the index and to any other subscriber who so requests.

Will Make Motors

The Springfield Motors Co., a Delaware corporation with a capital of $5,000,000, recently organized to make the Knox motor for aeronautic, commercial and marine purposes, plans to occupy the entire plant of the Knox Motors Co. in Springfield, Mass. Eventually the tractors made by the Knox Co., will be manufactured elsewhere. The new company expects to produce at least 25,000 motors annually.

William J. Fleming and R. C. Bourne, of the Bourne-Fuller Co., Cleveland, have started on a two months' trip to the Hawaiian Islands.

(*For complete prices see page 288.*)

Billet Inquiry

Includes 30,000 Tons for Export, Which Was Declined

Philadelphia, Jan. 22.—An export inquiry for 30,000 tons of 5 x 5-inch open-hearth rerolling billets for the manufacture of wire products was received by eastern Pennsylvania makers this week, but was declined, as the steel was not available. The billet situation with eastern makers is tighter than ever and it is practically an impossibility to ship in even the smallest quantities for any delivery this year. Prices are quoted at from $60 to $65, mill, for rerolling, and at from $75 to $85, mill, for forging billets. It develops that the round sale of ordinary open-hearth rerolling billets at $62.50, eastern mill, reported last week, represents 10,000 tons for delivery over the first half. This material will be shipped abroad. An inquiry for 5,000 tons of steel skelp from a domestic buyer in the Pittsburgh district is current. An independent mill recently has sold wire rods to domestic users at $75, mill. Some new inquiries for munition steel are coming out.

Sheet Bars Command $55

Pittsburgh, Jan. 23.—Rather heavy tonnages of sheet bars have been sold this week at $65, mill. Several consumers, who covered estimated requirements for the first quarter of the year several months ago, have purchased supplementary tonnages this year through brokers. So far as can be ascertained, no material has been obtained at less than $65, mill. Bessemer and open hearth billets are held at $60 to $65, mill. Belligerent European nations continue to figure in the market for semi-finished steel products. Wire rods are held at $75 to $80, Pittsburgh. Although the $70 price has not been withdrawn formally, it is not believed any tonnage can be obtained at less than $75. Muck bar nominally is quoted at $50, Pittsburgh.

Prices Uncertain

Youngstown, O., Jan. 24.—Description of the sheet bar market in the Mahoning valley still persists purely as literary effort—an imagining what prices would be if there were semi-finished material to be bought in anything like quantity. The nominal quotation may be said to hover around $65, but there are those who have been readily willing to pay $70 and more for such odd lots as could be bought. Practically no future business is being written. Most deliveries of sheet bars are to contract customers, at prices previously booked.

Shapes for a Navy Yard

Are Promised in 320 Days by the American Bridge Co.—No Improvement in Deliveries—Mills Are Very Conservative

New York, Jan. 23.—Much new inquiry for structural projects is in the market, especially for those of more than usual size, but awards are not numerous. There are further instances of buyers temporarily having abandoned projects after prices have been quoted. Inquiries in the metropolis are not active, but there are a few very large propositions which are being matured. A plan is current to erect a large office building on the site of the present Murray Hill hotel, Park avenue, which, it is estimated, may require 20,000 tons. The 9,000-ton Lucius apartment is in the active bidding stage. The market hears some talk of plans being developed to build a large auditorium. Numerous export inquiries for plain materials are being received by sellers. For Australia, several thousand tons have been asked. Plain material is quoted from 3.25c to 3.50c, Pittsburgh, or 3.419c to 3.669c by eastern makers. Some of the larger mills are quoting less, but for deferred deliveries.

More Contracts Placed

Pittsburgh, Jan. 23.—Several additional contracts for structural material have been placed this week with fabricators in this district. The McClintic-Marshall Co. will furnish about 2,000 tons for an addition to the plant of the General Electric Co. at Erie, Pa. The American Bridge Co. has received a contract for a bridge for the New York State barge canal, involving about 200 tons. Specifications for structural shapes, held at 3.10c for shipment at the convenience of the mill, are coming out in heavy volume.

Deliveries Are Delayed

Philadelphia, Jan. 22.—For 5,000 tons of fabricated steel for a crane runway at the League Island Navy Yard, the American Bridge Co., on proposals submitted today, entered the low bid of $128 per ton, erected, and stipulated delivery in 320 days. Shape deliveries with eastern mills record not the slightest improvement and the latter are doing all they can to discourage new purchases. There are inquiries in the market for second quarter contracts, involving considerable tonnage on which some of the makers are not inclined to quote. The indifferent attitude of the mills continues to arise from their heavy obligations which keep the producers in doubt as to whether they should make new sales. Plain material prices are from 3.50c to 4c, Pittsburgh, the latter applying to ship sections and to special lots for export. There is talk of a new inquiry for 15,000 tons of shapes from a Canadian car builder who is figuring on the large inquiry from France. The Carnegie Steel Co. has received several thousand tons for stock for the various navy yards at 3c to 3.10c, Pittsburgh, and for delivery to July, 1918. Plans are under way to increase the production of ship shapes among eastern mills.

Structural Buying Better

Chicago, Jan. 23.—The past week has brought about a larger volume of buying of fabricated material than has been the case for some time. Structural shapes continued quoted at 3.29c, Chicago mill, with comparatively little material available.

The largest item closed during the past week involves 1,570 tons for various bridges to be built by the Northern Pacific Railway Co. These will be fabricated by the American Bridge Co. The Virginia Bridge & Iron Co. has taken 1,600 tons for two sugar manufacturing plants in California. The remainder of projects closed in the west are for unimportant tonnages.

CONTRACTS AWARDED.

Northern Pacific Railway Co., various bridges at various locations 1,570 tons, to American Bridge Co.

Spreckels Sugar Co., structural steel for sugar plant at Manteca, Cal., 800 tons, to Virginia Bridge & Iron Co.

Amalgamated Sugar Co., structural steel for sugar plant at Tracy, Cal., 800 tons, to Virginia Bridge & Iron Co.

Larrowe Construction Co., three pulp dryer buildings at Mason City, Ia., Brighton, Colo., and Missoula, Mont., 270 tons, to American Bridge Co.

Continental Motor Co., Muskegon, Mich., plant buildings, 800 tons structural, contract to Lackawanna Bridge Co., Buffalo.

Garfield Smelting Co., addition to converter flue at Garfield, Utah, 129 tons, to Minneapolis Steel & Machinery Co.

Three factory buildings at Denver, Colo., (owners unknown) 128 tons, to Jackson-Richter Iron Works, Denver.

Addition to plant of the General Electric Co., Erie, Pa., 1,800 tons, to the McClintic-Marshall Co.

New York State Barge Canal bridge, 200 tons, to the American Bridge Co.

Johnson loft building, 149 Fifth avenue, New York, 2,100 tons, to Milliken Bros., Inc.

CONTRACTS PENDING.

Keith theatre, Syracuse, 700 tons, bids being taken.

Bridge over the James river at Richmond for the Atlantic Coast line and the Richmond, Fredericksburg & Potomac railroads, 3,000 to 4,000 tons, revised bids being taken.

High school, Hartford, 500 tons bids being taken.

Bridge for the Lehigh Valley railroad, 400 tons, bids being taken.

Bank building, Charleston, W. Va., 1,200 tons, bids being taken.

Crane runway for the League island navy yard, Philadelphia, 5,000 tons, American Bridge Co. low bidder.

Alterations to the plant of the Pierce-Arrow Motor Car Co., Long Island City, 450 tons, bids being taken.

Addition to the store of Abraham & Strauss, Brooklyn, 1,900 tons, indefinitely postponed.

Six wireless towers for the Atlantic Communication Co., Sayville, Long Island, 1,200 to 3,000 tons, depending upon final design.

Warehouse for the Eaton stores in Canada, 10,000 tons, recently reported, now understood will be located at Toronto.

Addition to the power plant of the Buffalo General Electric Co., Buffalo, 1,400 tons, bids being taken.

(For complete prices see page 288.)

Wire Trade

Is Not so Excited, But Demand is Very Heavy

Pittsburgh, Jan. 23.—Although demand for wire products continues heavy, the market is not nearly so excited as it was 30 or 60 days ago. This is not surprising in view of the fact that most consumers have enough tonnage under contract to meet their requirements for a couple of months. Cut nails are being held at $3.50 a keg by several of the more prominent makers in this district. Wire nails continue to be quoted at $3 a keg, the price adopted Nov. 24, last. Heavy demand exists for barbed wire for shipment abroad, but mills are unable to meet specifications for delivery.

Will Be Reopened

Beaver Dam, Wis., Jan. 23. — The plant of the Gray Iron Foundry Co., Beaver Dam, Wis., erected several years ago, but operated only a short time, it is to be re-opened about Feb. 1 by a new concern, known as the Beaver Dam Casting Co., which is being organized with $10,000 capital. The foundry, it is said, will be devoted exclusively to making cast iron and semi-steel castings for automobile construction. The new company has leased the plant for three years and will employ 50 molders at the start.

Mill Contracts Awarded

The Texas Rolling Mill Co., Fort Worth, Tex., has placed contracts for a 22-inch bar and billet mill and an 8-inch hoop and cotton tie mill with the Heinle Co., Pittsburgh, metal rolling engineers. The Texas company plans to replace engine driven roll trains with electric motors.

Coke is Lower

In Spite of Railroad Congestion and Spot Prices Decline

Pittsburgh, Jan. 23.—The market for Connellsville coke is not running true to form. Blast furnace fuel has been sold at comparatively low prices this week, despite congested traffic conditions which have been responsible for the banking of numerous blast furnaces in this district. Blast furnace managers in some instances declare they will bank furnace fires before paying holiday prices for fuel. Forty-eight hour coke has been selling at a range from $8.50 to $9.50 a ton at the ovens for spot shipment the last few days. Some coke has been sold at as low as $8, ovens, for immediate shipment. The market for contract fuel is quiet. Seventy-two hour coke is unchanged in price. *The Connellsville Courier,* for the week ending Jan. 13, says production of coke in the Connellsville regions was 353,192 tons, compared with 358,576 tons the week before.

More Reasonable Prices

Cleveland, Jan. 23.—Delivery of coke has improved to such an extent that sales of prompt are now being made on a basis of $10.50, ovens, for Cleveland delivery. Most foundries are getting along fairly well with their contract coke.

Strong at Cincinnati

Cincinnati, Jan. 22. — Shipments of coke by railroads are reported to be a little better, but they are still far from satisfactory. A large number of melters are unable to get as much fuel as desired, which has resulted in serious curtailment of operators in some instances. Most Wise county operators are holding at the advance price of $7.50, ovens, for 1917 delivery, which took effect last week. One or two sales are reported made around $6, ovens, for foundry coke, but the majority are holding at the higher figure. No quotations are out for furnace coke from either Pocahontas, Wise county, or New River districts. Pocahontas foundry coke can be had around $6, ovens, for shipment over the entire year or the first half. New River prices are given from $6.50 to $7.50, ovens, for any delivery over 1917. Inquiry for lots to fill in between shipments are numerous, but can only be supplied occasionally, because of inability of railroads to ship contracts already on hand.

Shortage in the South

Birmingham, Ala., Jan. 23.—Need of coke in ironmaking is again felt seriously in the Birmingham district. The Gulf States Steel Co. will hardly get its 37 Koppers by-product coke ovens completed and ready for operation for 60 days. In the meantime, considerable coke is being purchased on the open market, in addition to that being manufactured at the Virginia mines of the company. The Sloss-Sheffield Steel & Iron Co. is also purchasing in the open market as is the Anniston Operating Co. The Woodward, Tennessee and Republic companies are making coke for their own needs practically to full requirements. The Alabama Co. has but two blast furnaces in operation and is constantly watching the coke supplies. A number of old bee-hive coke ovens, recently rehabilitated, have been started up in this district, but outside business has been accepted in quantity and the coke is badly needed. Shipments to Mexico smelting plants could be increased if the coke was available and railroad cars to be had with which to move the product.

Coal mining operations in Alabama are still being interfered with because of the railroad car shortage. No early relief is in sight on two railroads which handle a large tonnage of coal.

Easier Conditions

Philadelphia, Jan. 23.—Easier conditions continue apparent in the coke market for early delivery. An eastern furnace bought spot furnace coke within the week at $8, Connellsville ovens. There also were purchases at $8.50, ovens. The spread of the market now is considered to be from $8 to $8.50, ovens.

By-Product Sold

St. Louis, Jan. 22.—Connellsville 72-hour foundry coke is quoted all the way from $11 to $12 a ton, f. o. b. ovens for spot delivery. And many of the ovens are refusing to quote on contracts. The market is very firm. Terre Haute by-product coke is offered at $11, with practically all of the output sold up for several months.

Mr. Parrott's New Position

L. C. Parrott, for four years assistant purchasing agent of the Standard Parts Co., Cleveland, formerly the Standard Welding Co., has tendered his resignation to take effect Jan. 31. Mr. Parrott, who is widely known in the iron and steel industry, has accepted the position of purchasing agent of the Otis Steel Co., Cleveland, and will take up his new duties Feb. 1.

(*For complete prices see page* 288.)

Canton Concern

Announces New Appointments in Its Organization—Officials Advanced

The Berger Mfg. Co., Canton, O., announces the following appointments:

R. W. Van Horn, who, for the past six years has been connected with the New York branch of the company in charge of the metal-lumber department, has been transferred to the home office and placed at the head of the building-material products division. Previous to his connection with the Berger company, Mr. Van Horn was chief inspector of materials for the W. & L. E. railroad.

Norman A. Hill, recently efficiency engineer of the DuPont Powder Co., Wilmington, Del., and formerly engaged in appraisal work for the public service commission of Maryland, has been appointed efficiency engineer with headquarters at the company's home office. Mr. Hill is a graduate of the University of Pennsylvania and has completed postgraduate courses at both Pennsylvania and Columbia universities.

The sidewalk light department of the company has been placed in charge of P. V. Stonerod, formerly inspector of steel for the Carnegie Steel Co. Mr. Stonerod has been with the New York branch of the company in capacity of construction engineer for the past few years.

A. Bromley Jr., contracting engineer, who for the past several years has taken care of the interests of the Berger company in the Cleveland territory, has been appointed chief engineer of the sales department and hereafter will be located in the home office. Mr. Bromley has had experience with the Vulcanite Paving Co., Philadelphia, as superintendent of the fireproofing department and also has had extensive experience as engineer with several construction companies.

Takes Over Business

Milwaukee, Wis., Jan. 23.—The LeRoi Co., Milwaukee, Wis., incorporated recently with a capital stock of $350,000, announces that it has taken over the automobile engine business established about three years ago by the Milwaukee Machine Tool Co., Sixteenth and Mitchell street, West Allis, under the direction of Charles W. Pendock, formerly a well known British engine and machine tool designer, and later designing engineer of a large Cleveland tool concern. Mr. Pendock has been elected president of the LeRoi Co. and will be its chief engineer and general manager.

Scrap Very Dull

In Most Centers—Hopeful Signs in a Few Places

New York, Jan. 23.—Dealers and brokers find it difficult to make new sales of any size in old material and the market remains exceedingly quiet. Prices are soft. Offerings are not heavy, but such as are in the market are being placed with greater difficulty. Embargoes continue a factor in keeping back new buying. For heavy melting steel, from $21.50 to $22, New York, is being offered, chiefly for export. A sale of steel axles at $39, delivered, in the east, is noted. Scarcity of vessel room has been blocking the development of recent new inquiries for export in which Italy has figured most prominently.

Prices Still Sag

Philadelphia, Jan. 22.—Prices of old material still sag on small or moderate sales, but buyers find trouble in getting tonnages at these figures and the market cannot be considered weak. Eastern Pennsylvania steelmakers have closed for 1,000 tons and less amounts of heavy melting steel at $21, delivered, and they now are offering $20.50, delivered, without takers. Brokers have made carload sales among themselves at $20, delivered. For export, $22, Philadelphia, is being offered by brokers who are covering against large orders to Italy. One eastern dealer is believed to have most of this business and is understood to be shipping an order for 40,000 tons. The Bethlehem Steel Co. again has been a heavy buyer of borings and turnings at $14 and $13, delivered, respectively. The Canadian government recently declared an embargo on further shipments of borings and turnings to this country for blast furnace use. A recent shipment of this kind involved 7,000 tons.

Dead as Door Nail

Pittsburgh, Jan. 23.—The market for old materials in the Pittsburgh district shows no evidence of life. More important melters have not bought any large tonnages since the latter part of November. Dealers have failed to arouse any interest in the situation, despite low prices. Heavy melting steel is hovering around $22 a ton, and other grades are correspondingly weak and irregular in price. Demand has fallen off for No. 1 wrought scrap for shipment to eastern points; this material now is quoted at about $24 a ton. Machine shop turnings are being offered at $11.50, but borings reflect moderate strength. They are held at $13 a ton by many sellers.

Little New Business

Buffalo, Jan. 23.—Buying in the Buffalo district, according to the dealers is awaiting relief from the prevailing congested condition of the railroads. There is little new business coming to light on this account, and the Buffalo district market is a stagnant one. Neither the users of scrap nor the yards seem to be interested at this time in the matter of large contracts. Here and there an effort is being made to get special lots for definite urgent needs through the traffic jam to destinations.

This situation has caused the dealers, who have been holding firmly to the advances made up to the turn of the year, to soften their schedules on a number of the commodities in the list. The scarcity of low phosphorus steel scrap and the demand for this line has caused the maximum to advance $2 per ton.

Stagnant at Cleveland

Cleveland, Jan. 22.—The market for old materials in the Cleveland territory is doing little more than marking time. The freight situation has let up a very little, enough to move a few of the odd lots of scrap sold. The only feature of any note in the price list is the marking down of short old steel rails from $26 to $27, to $23.50 to $24. Heavy melting steel continuing at from $21.50 to $22 is not attracting much business. The remainder of the last is dull and shows no immediate signs of movement in either direction.

Stronger at Cincinnati

Cincinnati, Jan. 22. — The feeling in the scrap market is more optimistic, and dealers are predicting an advance before the end of the week. It is known that a large number of melters are in need of supplies, and have been withholding purchases until more definite conclusions have been reached regarding peace talk.

Scrap Decline Checked

Chicago, Jan. 23.—After a steady decline in prices for several weeks, iron and steel scrap apparently has gained a firm level and is holding comparatively firm. Some dealers expect an upward movement when consumers again begin to buy, but probably classes will not again reach the level attained late last year. Consumers for the most part have not bought recently and have been using material from their reserve which must be made good in the near future.

One reason for the belief that higher prices will prevail later is that immense reserve stocks in the hands of country dealers some months ago have been absorbed and do not present the opportunity for obtaining material that was present previously.

Railroads are not offering much material, owing to lack of labor to gather and prepare it and lack of cars in which it could be transported. At present, there is practically no tonnage under consideration from railroads.

Better Feeling Prevails

St. Louis, Jan. 22.—There is a better feeling among the trading element in the scrap market, and although consumers are remaining inactive, the scarcity of scrap is holding prices without much change in either direction. Consumers are able to pick up a few odd lots at bargain prices, but aside from this, there is very little trading and no large tonnages are being offered. Standard section relaying rails, especially the heavier sections, are in great demand, but this supply is limited and such tonnages as are offered command fancy prices.

Cast iron car wheels are the only bright spot on the scrap list, as in view of the scarcity and high price of pig iron, consumers are substituting this grade to a large extent in their practice. There are no railroad offerings of any consequence in the market.

(For complete prices see page 288.)

Death of Philip C. Fosdick

Philip C. Fosdick, aged 59 years, president of the Cincinnati Gear Co., Cincinnati, died Jan. 22 at the hotel Halcyon, Miami, Fla., where he had gone in search of health. Death was due to uraemic poison.

Mr. Fosdick was one of the best known men in the machine tool industry in Cincinnati. When a young man, he entered the employ of the Dodge & Davis Machine Tool Co., Cincinnati, and later organized the Fosdick-Plucker Machine Tool Co., which was later dissolved upon the death of Mr. Plucker. In 1887, Mr. Fosdick organized the Fosdick Machine Tool Co., Cincinnati, and became president of that concern. In 1897, he sold his interest to that company, and became associated with the Kern Machine Tool Co., but resigned when that company moved its plant to Hamilton, O. He was then elected president of the Cincinnati Gear Co., which position he held at the time of his death. Mr. Fosdick was also keenly interested in politics and served as the director of public service of Cincinnati in 1914 and 1915. He was also president of the board of control for five years, and a member of the seventy-second general assembly of Ohio, from Hamilton.

Many Cars for Export

But Unusual Conditions May Interfere With Booking of Orders —France Proposes to Use German Prisoners

New York, Jan. 23.—The buying of cars is continuing in good volume. The week's orders total 2,500. Makers have before them approximately 50,000 cars for export, but to take this business, must assume the problem of erecting the cars abroad since it is provided that shipments shall go forward in parts. Labor and mechanical facilities required make builders hesitate to accept orders under these conditions. Financing of these purchases also is a factor.

The week's awards include 1,000 hoppers for the Virginian railroad to the Pressed Steel Car Co., 500 general service cars to the Western Car & Foundry Co., and 500 refrigerators to the Pullman Co., both for the Northern Pacific, 300 of various types for the Maine Central to the Standard Steel Car Co., and some scattering.

New inquiries include 200 for Woodward Iron Co., 250 for the St. Paul and 300 to 400 for the Richmond, Fredericksburg and Potomac.

Negotiations are continuing on the large car order for the French State Railways. It is learned that the specifications provide that these cars are to be shipped in a knocked-down state and are to be assembled by the builder in France. It is stipulated that German prisoners of war will be used to furnish the required labor.

The locomotive market still is active. The Buffalo, Rochester & Pittsburgh has placed 30 and the Chemins de Fer du Midi, of France, 40 with the American Locomotive Co. The Southern Pacific has ordered nine from the Baldwin Locomotive Co., which is in addition to 24 placed with the American Locomotive Co.

The Baldwin Record

Philadelphia, Jan. 23.—During 1916, the Baldwin Locomotive Works completed 1,989 locomotives, of which 1,336 were of steam; 295 of electric and 258 of gasoline types. Exports amounted to 47 per cent of total capacity and included 297 for France, 65 for England and 12 for Russia. Among the large orders for foreign countries received during the year were 150 for Russia, 397 for France, and 665 for Great Britain. At the end of the year, 21,347 men were employed.

French Want Rails

Pittsburgh, Jan. 23.—Tentative inquiries for 50,000 tons of steel rails for shipment to France have come out within the last few days. The Russian government continues to figure on 300,000 tons of rails, negotiations for which were opened some time ago.

Alaskan Rails Placed

Chicago, Jan. 23.—The feature of the steel market recently is the placing of 10,000 tons of standard rails by the United States government for use in Alaska. The inquiry was for 25,000 tons and it is intimated that a second order for 10,000 tons may be placed shortly.

Demand and frequent sales continue in track fastenings, although the tonnages are comparatively small.

Cast Iron Pipe

Inquiries Come from China and India —Market Quiet

New York, Jan. 23.—The cast iron pipe market continues quiet in eastern territory. Private buyers continue to put out a fair amount of inquiry and are making some purchases for spring delivery, but these do not run to large tonnages. The municipalities are making few inquiries. On 2,300 tons for Baltimore, the United States Cast Iron Pipe & Foundry Co. submitted the lowest bid at $47.50, delivered, for the 3-inch; $40.50 for the 4-inch, and $37.50 for the 6 to 48-inch. Export inquiries are appearing constantly, but there are not many sales of this character. A new inquiry for India calls for about 2,000 tons of 12-inch and 200 tons are wanted for Shanghi, China. Prices on moderate-sized lots are firm, but it is to be noted that there is some shading on the larger and more attractive propositions.

Another Furnace for India

A third modern blast furnace of 500 tons daily capacity is to be added to the plant of the Tata Iron & Steel Co., Sakchi, India, of which C. P. Perin, 2 Rector street, New York City, is the consulting engineer. The contract for the plate work has been awarded to the Wm. B. Pollock Co., Youngstown, and the erection of the plant will be done by the Tata company's own organization. The new furnace will increase the pig iron group of the company to three stacks with an output of about 1,000 tons daily. A fourth furnace has been in contemplation, but no decision yet has been made to proceed with its erection. Mr. Perin also is consulting engineer for the building of a charcoal blast furnace for the state of Mysore, India, which will produce about 20,000 tons annually.

(For complete prices see page 288.)

Daniels Says

Government Must Go Into Manufacture of Munitions

Washington, Jan. 23.—In an official statement, Secretary of the Navy Daniels declares that only government munition manufacture would prevent a serious peril to the entire preparedness program. The secretary defended award of recent shell contracts to the British firm of Hadfield & Co.

The statement declared the actions of certain American manufacturers lent color to the oft-repeated charge that "preparedness is a synonym for profits, and not patriotism." It adds:

"Nothing but the utter failure of the most patient negotiations and appeals to the patriotism of the little group of steel manufacturers which has a practical monopoly of this business has made it imperative for the government to build a projectile factory and give a contract to a foreign bidder. The Bethlehem Steel Co., which has been filling the papers with advertisements criticizing the navy department, admits in its latest advertisement that, though it was two years ago awarded a contract for $11,500,000 of shells, it has not yet made shells to meet the requirements of the navy department.

"Were there no relief, through competition either by the government or by other more patriotic firms, I would feel that our entire program of preparedness was in peril."

Obituaries

John I. Souther, for a number of years superintendent of the blast furnace of the Cambria Steel Co., Johnstown, Pa., died Jan. 20, while visiting at Richmond, Va. Mr. Souther had made his home in Cleveland during the past two or three years.

George A. H. Mould, a civil engineer, well known in iron and steel structural circles, and in recent years associated with C. T. Wills, Inc., New York general contractor, died Jan. 21 at his home in Brooklyn. He had supervised construction work in various foreign countries for Milliken Bros., Inc.

John C. Lawler, superintendent of the transportation and labor department of the Homestead Steel Works of the Carnegie Steel Co., died at his home in Munhall, Pa., Jan. 21.

Heroult Furnaces

Will be Built at Canadian Munitions Plant

Toronto, Jan. 22.—The imperial munitions board has secured from the Toronto harbor commission a site for a large munition plant in the Ashbridge Bay industrial district on the water front. The plant, which will be devoted to electrical steel and forging work will cost $300,000 and will have an initial capacity of 300 tons per day, employing about 800 men. There will be 10 6-ton, 3-phase, 25-cycle heroult type electrical furnaces, for which licenses have been issued by the United States Steel Corporation, each furnace consuming about 2,000 horsepower electricity which will be supplied by the hydro-electric commission. It is expected that the ultimate use of the plant for commercial industry will require about 60 acres, with modern dockage and rail facilities. Construction work is to be commenced immediately. The harbor commission has placed its entire engineering and construction department forces at the disposal of the imperial munitions board.

Tungsten Market Quiet

New York, Jan. 20. — The tungsten ore market is quiet and has been characterized by a smaller volume of business during the week than usual. A number of sales have been made, but most of them involved small tonnages. The largest involved nearly 25 tons of Bolivian concentrates, 60 per cent or better, and low in impurities, which went at $16. The market continues to be represented approximately by the range $16 to $16.50 per unit of tungsten trioxide, 60 per cent or higher metallic content, and low in sulphur, arsenic, tin, phosphorus and other objectionable impurities.

A number of fairly large tonnages are pending. Including these are 100 tons for export, which are expected to be closed shortly, and several tonnages for domestic consumers, including one involving 20 tons and another 15 tons.

Drop Forge Headquarters

The American Drop Forge Association announces that the association headquarters during the week of the Chicago automobile show will be at the La Salle hotel where a room has been reserved on the mezzanine floor for the use of any representatives of the drop forging trade visiting Chicago at that time.

A cordial invitation is extended to every drop forger to call at the headquarters and register his name and Chicago address during the show; also to partake of a complimentary luncheon to be served at the La Salle hotel to members of the trade at 12:30 p. m., Wednesday, Jan. 31.

The next general meeting of the association will be held in Cleveland, at the Hotel Statler, June 14-16.

Lake Carriers

Hold Annual Meeting in Detroit—Must Purify Water

The Lake Carriers' Association held its annual meeting at Detroit last week. The members of this association operate a total of 414 vessels of all classes, with an aggregate gross tonnage of 2,013,962.

Unanimous approval was given to two resolutions which are designed to minimize any delays that might occur in placing the vessels in operation this spring. These delays, if not avoided, might seriously restrict the movement of iron ore this season. The association was informed that the bureau of public health has stated that no vessel will be allowed to leave port this spring unless an approved method of water purification has been installed. A committee was authorized to consider the question promptly. Another committee also was authorized to take up the problem evoked by the recently announced ruling of the attorney general that boats built since 1897 must conform in their construction to the seamen's act.

A resolution was adopted by the association strongly urging the government to widen the Livingstone channel from 300 to 450 feet. The success of the Great Lakes fleet in moving immense tonnages of freight each summer rests largely on the quickness with which the vessels are moved, and the wider channel is needed to minimize the possibilities of collisions and delays.

The officers of the association were re-elected as follows: William Livingstone, president; Harvey D. Goulder, general counsel; George P. McKay, treasurer; George A. Marr, secretary and assistant treasurer. J. S. Ashley was elected vice president to succeed the late J. H. Sheadle, former vice president of the Cleveland-Cliffs Iron Co., Cleveland. The executive committee includes Mr. Livingstone, Mr. Ashley, Harry Coulby, John Mitchell, D. Sullivan, G. A. Tomlinson, C. L. Hutchinson and Horace S. Wilkinson.

George Naylor Jr., member of the firm of Naylor Bros., Peekskill, N. Y., manufacturers of stoves, died recently.

Points of Interest

Will be Visited by Mining Institute on Western Trip

Chicago, Jan. 22.—The Lake Superior Mining Institute has issued a circular outlining arrangements for the twenty-first annual meeting, known as the Menominee-Birmingham meeting. The sessions will be held at Birmingham, Ala., March 13 to 15, inclusive.

Members and guests will assemble in Chicago Saturday, March 10, with headquarters in the Elizabethan room of the Congress hotel. Railroad and sleeping car accommodations can be obtained there. The special train over the Queen & Crescent route will leave at 11:30 p. m., from the Illinois Central station at Twelfth street, over the Big Four railroad. Chattanooga, Tenn., will be reached Sunday evening at 6:25 p. m. and the next morning at 8:45 o'clock a trip through Chickamauga National Military park and other points of interest will be made. The trip from Chattanooga to Birmingham will be made Sunday night, arriving at the latter point at 6:00 o'clock Tuesday morning.

The train will leave Thursday evening at 11:00 o'clock for Knoxville, where the day will be spent in side trips. Chicago will be reached about noon Saturday.

Death of W. J. McBride

W. J. McBride, president of the Michigan City Car Co. and until a year ago president of the Haskell & Barker Car Co., died Jan. 19 at Chicago, aged 55 years. He formerly was auditor, vice president and general manager of the American Car Co. at St. Louis. In 1910 he became president of the Haskell & Barker Co. on the death of John H. Barker. He was educated in the public schools at Detroit and began his business career at the age of 16 years with Peninsular Car Co. of Detroit. When this company was merged with the Michigan Car Co., he was made secretary and in 1899 went with the American Car Co. as auditor, rising to the position as first vice president and general manager. Burial was at Detroit.

New Foundry

Hartford, Wis., Jan. 23. — A new foundry and machine shop is being established at Hartford, Wis., under the name of Hartford Iron Works, by I. L. Bonniwell and Louis Rosche. It will make a specialty of plow points and hardware specialties on custom orders. Mr. Rosche is an expert foundryman and will be general manager.

MEN OF THE IRON TRADE

Who they are **Where they are** **What they are doing**

CECIL E. BERTIE has severed a long connection with the sales organization of Rogers, Brown & Co. to become assistant to President John B. Newton of the Virginia Iron, Coal & Coke Co. and has assumed his new duties with headquarters at Roanoke, Va. Mr. Bertie began his career in the iron business in 1904 with the Chapman Iron, Coal & Coke Co., Goshen, Va., giving attention to shipping, accounting and purchasing details. In September, 1906, he went to the Northern Iron Co., Standish, N. Y., where he superintended shipments. In November of that year, he accepted a position in the sales department of Rogers, Brown & Co. and was attached to the New York office, remaining there until April, 1907, when he was transferred in a similar capacity to the Philadelphia office of the firm. In March, 1911, he took up temporary special work for the Roanoke Gas & Water Co., Roanoke, Va., returning to the Rogers-Brown organization in August, 1912, when he became a salesman with the Chicago office. In May, 1914, he again became connected with the Philadelphia office in a sales capacity and remained there until his appointment to the executive offices of the Virginia Iron, Coal & Coke Co. Mr. Bertie enjoys a wide acquaintance in the eastern and Virgina iron trade.

Robert J. Shirley, engineer and works manager for the Chapman Valve Co., Indian Orchard, Mass., has resigned.

W. W. Taylor, vice president and general manager of the Oriskany Ore & Iron Corporation, Lynchburg, Va., has resigned to take up other business.

Dr. A. F. Zahm, formerly head of the research department of the Curtiss Aeroplane Co., Buffalo, has accepted a government post.

Wm. F. Neu, of the Steel Rail Supply Co., 2 Rector street, New York, has been elected a director of the Merchant's National Bank, New York.

G. L. Robinson, of the iron and steel department of Gaston, Wigmore & Williams, 140 Broadway, New York City, has sailed for Europe to promote the trade of his department.

James A. Wakefield, attorney at law, Pittsburgh, talked about "The Battle of Mons", at the January meeting of the Pittsburgh Foundrymen's Association, Jan. 15, at the Fort Pitt hotel.

N. M. Emerick, connected with the traffic department of the Brier Hill Steel Co., Youngstown, has resigned to become traffic manager of the Wilkoff Bros. Co., that city.

William G. O'Malley, manager of the Midland plant of the Pittsburgh Crucible Steel Co., has been elected director of the Midland Savings & Trust Co., Midland, Pa.

M. A. Purvin has been appointed manager of the Chicago office of the United Smelting & Aluminum Co., New Haven, Conn. The Chicago office will be located at 959 Monadnock block.

CECIL E. BERTIE

L. E. Thomas has been appointed general manager of the Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa. Mr. Thomas is also vice president of the company.

Clarence H. Howard, president of the Commonwealth Steel Co., St. Louis, spoke at the annual dinner of the Employment Managers' association at Hotel Lenox, Boston, the night of Jan. 9.

W. J. Radcliffe, formerly vice president and general manager of the E. A. Kinsey Co., dealer in machinery and supplies, Cincinnati, has been elected president and general manager of the company.

Marcus Edward O'Brien, foreman of the pattern shop of the Morgan Construction Co., Worcester, Mass., has resigned to become superintendent of a bolt and nut company in Erie, Pa. The employes of his department presented him a gold watch and chain as a mark of esteem, Jan. 20. Frank H. Freitag, inspector and assistant to Mr. O'Brien, will suceed him.

Arthur Aigeltinger, vice president of the Manganese Rail Co., New York, has been made president of the company, succeeding W. C. Pearce, who has been made chairman of the board.

Geo. S. Gates, for a number of years connected with the iron and steel trade in Philadelphia and New York, has associated himself with the Philadelphia office of Chas. Dreifus Co., 1312 Widener building, iron and steel scrap.

J. G. Blunt has been made mechanical engineer of the American Locomotive Co., with headquarters at Schenectady, N. Y. He has been superintendent of the general docking room of the company.

George Giffault, for many years connected with Fitz, Dana & Brown, metal dealers, New York, and widely known in the metal trade, has become identified with the staff of the North American Copper Co., 52 Vanderbilt avenue, New York, effective Jan. 22.

Dr. Edw. Fitch Northrup, research physicist of Princeton University, has been awarded the Elliott Cresson medal by the Franklin Institute of Philadelphia "in recognition of his electrical inventions and high temperature investigations".

E. J. Parrock, connected with the steam engineering department of the Youngstown Sheet & Tube Co., Youngstown, has resigned to accept a position with the Canadian Steel Corporation, which is building a plant at Ojibway, Canada.

H. T. Liang, of the American office of the Wah Chang Mining & Smelting Co., Woolworth building, New York, shortly will return to Changsha, China, where the headquarters of his company are located, for a visit of several months.

F. W. Amis, with Pilling & Crane, 71 Broadway, New York City, has been made representative in the United States of the Eastern Car Co., New Glasgow, Nova Scotia. He has been placing numerous orders for iron and steel and other supplies for car manufacturer especially in connection with the recent order placed by Russia with the Eastern company.

Bethlehem Plan

Calls for Issuing Stock Dividend of 200 Per Cent

New York, Jan. 24.—An increase in the common stock of the Bethlehem Steel Corporation from $15,000,000 to $60,000,000 is planned as a method of capitalizing the profits of the company. This announcement was made at a meeting of directors Tuesday afternoon. Of the new stock, $30,000,000 will be given to stockholders as a 200 per cent stock dividend on the basis of two shares for each share now held; the additional $15,000,000 will be offered to stockholders at par. The increased capital will have no voting power. Charles M. Schwab and his associates control the present issue and Mr. Schwab promised the British government there would be no change of stock control during the war. The non-voting clause also enables holders of preferred shares to retain their voting strength in the administration of the company's affairs.

Directors declared a quarterly dividend of 10 per cent, or an increase of 2½ per cent a quarter over the disbursement made in 1916. Provided stockholders approve the stock increase, regular dividends at the 10 per cent rate will be paid the next three quarters.

The earnings for the past year are announced as having been $61,717,329. Interest charges were $3,772,575. Allowance for depreciation was $14,350,785, leaving a balance of $43,593,968, an increase of $25,831,156 over 1915. Addition of this balance to the previous surplus brings the total to $69,370,000 at the year end, out of which the new cash dividend is declared.

Orders on hand at the beginning of 1917 amounted to $193,500,000, exceeding those of a year ago by $18,000,000, despite the heavy operations of 1916. The funds provided from the sale of the new stock will be used for improvements, it is planned. A special meeting of stockholders has been called for Feb. 14, when the directors' recommendations will be considered.

Increasing Capacity

The following directors were elected, Jan. 23, at the annual meeting of stockholders of the Pennsylvania Engineering Works, New Castle, Pa.: George Greer, Charles Matthews, R. C. Pattison, Edward King, C. L. Baldwin, J. K. Furst and E. W. Beadel. Directors elected officers as follows: President and general manager, E. W. Beadel; vice president and chief engineer, J. K. Furst; secretary and treasurer, C. L. Baldwin; superintendent, W. H. Shipler. The company is increasing the capacity of several of its departments to fill an unusually large volume of orders for blast furnaces, metal mixers and converters.

Mining Engineers

To Convene in New York Next Month—Program is Elaborate

The one hundred and fourteenth meeting of the American Institute of Mining Engineers to be held at the Engineering Society's building, New York, Feb. 19 to 22, inclusive, promises much of unusual interest to men of the iron and steel industry. The program which has been arranged for this meeting is elaborate and covers a wide variety of topics. The first day of the meeting will be devoted to registration and sessions on petroleum and gas and on milling and smelting. The feature for the evening will be a college reunion night. Graduates of the different colleges will be seated together at tables reserved for the purpose. The business meeting will be held on Tuesday. Simultaneous sessions on iron blast furnace practice and on flotation will be held in the afternoon. The annual dinner will be given in the evening at Hotel Astor and will be followed by dancing. Wednesday will be devoted exclusively to technical sessions, which include sessions on the manufacture of iron and steel, metallography and heat-treatment of steel and on mining methods. An entertainment and lecture will be given in the evening at the Engineering Society's building. An excursion to West Point has been arranged for Thursday. Exhibition horseback riding and inspection of the buildings have been arranged for the visitors. A special program of entertainment for the ladies has been arranged which includes luncheons, theater parties, and a visit to the art galleries of Senator W. A. Clark.

The Non-Ferrous Metals

Copper Lead Spelter Tin

New York, Jan. 23.—Prices on copper, tin, lead and aluminum have reflected a strong advancing tendency during the week closing today; spelter has remained practically unchanged, while aluminum has undergone a further reaction. Copper, by reason of the great scarcity of nearby metal, combined with a brisk demand, has advanced approximately 2½c since last Tuesday. Some of the buyers who were short of January copper now have agreed to take February, with the result that the pinch on January has been relieved, and the market now is quiet but firm. Electrolytic is quoted as follows, on the basis of delivery, cash in 30 days; January, 32c to 32.50c; February, 31.25c to 31.50c; March, 30.75c to 31c; second quarter, 29.25c to 29.50c. Lake copper is quoted at 30.50c to 31c, usual terms, for January, and 30.25c to 30.75c for February. Casting copper is quoted at 28.50c to 28.75c, cash, for January.

The holding up of the usual London price cables by the British censor of late has added considerably to the difficulties of tin sellers. These cables now are being received about three or four days following the date on which they have been sent. Traders here, however, have been receiving their limits so that offerings have been made right along. The week generally has been a quiet one in tin, but several hundred tons of futures have changed hands. Spot transactions have not totaled a large volume. Spot Straits is exceedingly scarce and now is quoted nominally at 45.50c, New York. Much of the current business involves February arrival, which is being done on the basis of approximately 44.75c to 45c for early February.

Lead for January shipment has been in active demand during the week, due to some extent to the railroad congestion in the middle west, which has prevented the delivery of material now en route to plants. As a result, spot lead in New York has been at a premium. January shipment now is quoted at 7.80c, New York, and 7.75c, St. Louis. Lead for February shipment, for which demand has been limited, is quoted at about 10 points less. The American Smelting & Refining Co. continues to quote 7.50c, New York.

The spelter market has remained practically unchanged during the week, although prices have shown a slightly easier tendency, due to the falling off of demand. Prime western now is quoted as follows: Prompt and January, 9.75c to 9.87½c, St. Louis; February, 9.62½c to 9.75c; March, 9.50c; April, 9.25c. Brass special now is commanding premiums of 1c to 1.12½c over the prime western price.

A strong situation has developed in the antimony market, due to the scarcity of metal here for spot delivery, to the delay in unloading vessels which have arrived here with antimony during the past few weeks, and to the small amount of unsold antimony now on the way to this country. A sale of 25 tons of spot was made out of warehouse yesterday at 15c, in bond, equivalent to about 16.50c, duty paid. The market on spot now may be quoted at 16c to 16.50c, duty paid. January-February shipment from the Orient is offered at 12.75c, in bond, and March-April shipment at 12.25c, in bond.

Prices on ingot aluminum for prompt and nearby shipment have reacted due to increased second hand offerings. No. 1 virgin in carload lots now is quoted at 56c to 58c; No. 1 remelted at 51c to 53c, and No. 12 remelted at 37c to 39c.

(For complete prices see page 288.)

Grain Growth Phenomena in Metals

Further Discussion on Germinative Temperature Phenomena and Other Characteristics of Grain Growth Which Have Occupied the Attention of Prominent Metallurgists During the Past Few Years

BY ZAY JEFFRIES

THE development of grains of macroscopic size at the germinative temperature should be considered the extreme condition of a general rule. When considered in this light it is not strange that the development of these large grains should be the exception and not the rule. One of the principal factors influencing the operation of the laws of fast growth temperature is the rate of heating.

The germinative temperature has been defined as the minimum temperature at which two adjacent grains can coalesce to form one large grain, provided that this larger grain will have sufficiently increased its power of attack, to enable it to absorb adjacent grains which cannot coalesce with each other. Time is always to be understood as a factor governing the first stage of grain growth. If the time of heating is short, the germinative temperature is raised. The formation of large grains in metals may occur at relatively high temperatures when the rate of heating is rapid. It is to be understood that in such cases grain growth must be very rapid, the germinative grains having the power to absorb the inert grains before the latter can coalesce with one another. The rapidity of absorption of the inert grains by the germinative grains is at times almost beyond comprehension. In one instance, the author calculated that 37,500,000 individual grains were absorbed by one germinative grain in 10 seconds. The grain growth took place at such a temperature that the inert grains would have coalesced freely with one another, had time been given. A further increase in rate of heating will prevent the formation of coarse grains.

Figs. 1 and 2 show visually the effect of rate on the formation of large grains. Fig. 1 represents a section of metal held at the fast growth temperature for 30 minutes. This is a sample of compressed metal heated with electric current in which the temperature gradient was the cause of the selective grain growth. The photograph is at a magnification of five diameters and the grains can readily be seen macroscopically. Fig. 2 represent a section of the same metal in which the temperature was raised quickly to a point far above the germinative temperature range, and held at this temperature for 30 minutes. Some of the larger individual grains in Fig. 1 occupy an area equal to about 1,000 average grains in Fig. 2. The lines in Fig. 2 are cracks which formed in the specimen during mounting. The mean grain size of the fine-grained areas in Fig. 1 is very much less than the mean grain size in Fig. 2. The grain size at the center of Fig. 1 represents about the normal grain size just above the fast growth temperature. The grain size shown in Fig. 2 is approximately the equilibrium grain size for a temperature several hundred degrees above the fast growth temperature.

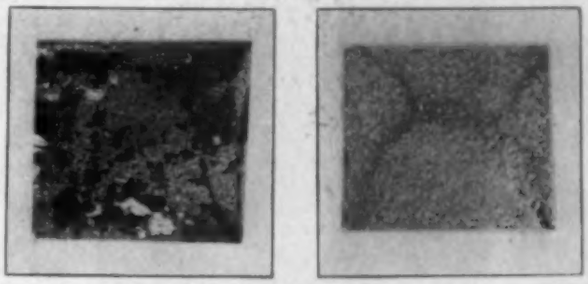

FIG. 1—SECTION OF METAL HELD AT GERMINATIVE TEMPERATURE FOR 30 MINUTES—FIVE DIAMETERS. FIG. 2—THE TEMPERATURE WAS QUICKLY RAISED ABOVE THE GERMINATIVE RANGE AND HELD FOR 30 MINUTES

The specimen shown in Fig. 3 is magnified 18 diameters and indicates the large grains formed at the germinative temperature in the process of absorbing the equilibrium grains in the hotter portion of the sample. The specimen shown in Fig. 4 is also magnified 18 diameters and represents the same phenomenon when nearly all of the small grains have been absorbed.

Resistance to grain growth might be divided into two parts: The resistance to grain growth inherent in the pure predominating constituent; for example, copper in the pure state at a certain temperature has a certain inherent resistance to grain growth; and the resistance to grain growth due to obstruction by foreign bodies; for example, copper oxide in copper or pearlite in low-carbon steel.

While it might seem anomalous, high resistance to grain growth due to the second cause greatly favors the formation of very coarse grains at the germinative temperature. As the resistance to grain growth increases in a given material the germinative temperature increases, and the time necessary for the formation of the large grains decreases rapidly. As an example of the above, a sample of metal containing 2 per cent of non-metallic material required about 1½ hours to form the large grains at a comparatively low germinative temperature. The same metal containing 10 per cent of non-metallic material required but 2 or 3 minutes to form the course grains. The coarse grains in the latter case were larger than those of the former. In the sample containing 10 per cent of non-metallics (by volume) the germinative temperature was only 100 degrees Cent. below the fusion temperature. The addition of 12 per cent non-metallics was sufficient to raise the germinative temperature above the fusion temperature and hence make it non-existent.

If it is considered that high resistance to grain growth favors the formation of coarse grains, then, naturally low resistance to grain growth would defeat their formation. The explanation of this is found in the fact that as the resistance to grain growth increases, corresponding to a rise in the germinative temperature, the existing grains at the germinative temperature are very much smaller than the equilibrium grains for that temperature. Since the grains are so far out of equilibrium as regards size, when the germinative grains reach a size considerably larger than the existing grains, the latter are absorbed rapidly; first, because they are so small, and second, because the temperature is so high. On the other hand

The author of this paper, which will be read at the February meeting of the American Institute of Mining Engineers, is assistant professor of metallurgy, Case School of Applied Science, Cleveland.

the mechanism of the fast growth phenomena operates in the reverse order for low resistance to grain growth. In the first place the germinative temperature is low and the existing grains at the fast growth temperature are more nearly in equilibrium in regard to size. This, coupled with the actual lower temperature, will materially reduce the velocity of grain growth as well as the size of the maximum grains at the fast growth temperature. In order that selective grain growth may take place at all, it is essential that the existing grains at the fast growth temperature should be smaller than the equilibrium grains for that temperature. As a general rule, it might be stated that, other conditions being equal, the finer the existing grains at the germinative temperature, the greater will be the tendency toward selective grain growth.

Grain size prior to deformation has an important influence on the operation of laws of fast growth temperature. It is easily possible in pure metals either to help or defeat the selective grain growth at the germinative temperature. If very large grains have been formed by previous high temperature anneal, like normalizing of nearly pure iron such as Professor Sauveur used in his experiments, it is probable that the grain fragments which formed in the cold-bent specimen after annealing were so large that the germinative temperature phenomena were largely masked. In addition to this, the germinative temperature would be so low that the velocity of grain growth would be decreased. Since the coalescence of adjacent grains in the grain growth region is a function of time, among other things, it is probable that grains not far removed from the centers of selective growth might coalesce with each other before the larger grains in their conquest would have time to absorb them.

While Prof. Sauveur observes that coarse grains did not form in nearly pure iron, it has been the writer's experience that there is nearly always a region in which the grains are larger than those on either side. Sometimes the difference is not great enough to be unmistakably observed in the ordinary microscopic examination, but grain-size determinations usually show the difference.

In a given pure metal with a given amount of cold deformation, the grain size before deformation will have a marked effect on the selective grain growth during annealing. If the initial grain size is large, the grain fragments formed during annealing will be correspondingly large, and if the initial grain size is small, the grain fragments will also be smaller than in the previous case. The latter condition is conducive to the formation of large grains at the germinative temperature. Instead of normalizing the pure iron, if Prof. Sauveur had given it an initial treatment so as to produce small grains, he would have noticed a more marked recrystallization effect after cold deformation with subsequent annealing. On the other hand, if the grains are initially very large, it is possible almost completely to mask the fast growth phenomenon.

Temperature and Deformation Gradients

The formation of large grains at the germinative temperature is dependent upon a rather even grain size with a temperature gradient or an even temperature with a deformation gradient or any combination of the

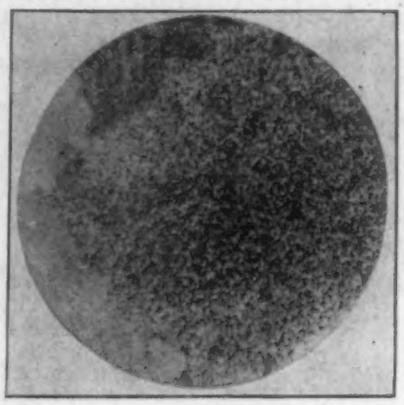

FIG. 3—THE LARGE GRAINS FORMED AT THE GERMINATIVE TEMPERATURE DURING ABSORPTION OF EQUILIBRIUM GRAINS IN THE HOTTER PORTION OF THE SAMPLE—18 DIAMETERS

two. In compressed metals heated by electric current the grain size is usually quite uniform and the temperature gradient serves to start the formation of the large grains.

If a metal is deformed in the cold in such a manner that the degree of deformation differs progressively from point to point—for example, in a bent metal bar (the neutral axis of the bar will have no deformation, but the edges perpendicular to the neutral axis will have a maximum deformation)—there will be a deformation gradient from the surface to the neutral axis. If a bar so bent be heated in a muffle, it might be considered that there was no temperature gradient, but the deformation gradient, with temperature constant, would produce a recrystallization gradient in which the parts most severely deformed would recrystallize at the lower temperature. This difference in temperature of recrystallization furnishes the cause for the selective grain growth due to deformation gradients. Various combinations of temperature and deformation gradients might be encountered. For example, the condition might obtain in which the temperature gradient just counterbalances the effect of deformation gradient, and fast growth at the proper temperature would not occur. Local deformation gradients occur in any metal which has been cold plastically deformed, due to the variations in the directional properties and size of adjacent grains.

If the total cold deformation of a piece of metal has been moderate, such as would obtain after one or two passes through rolls, the local deformation gradients may give rise to a comparatively few germinative grains which during heating absorb the inert grains, thus causing coarse crystallization. As the degree of cold deformation increases, the local deformation gradients will decrease. When the total average cold deformation exceeds about 30 or 40 per cent reduction in area of the metal, the number of germinative grains formed during normal muffle heating may approximately equal the number of equilibrium grains for the maximum temperature reached during annealing, and thus the metal is said to be fine grained. The above adequately explains the cause of coarse crystallization during annealing of moderately cold deformed metals, and the formation of progressively finer grains with the same heat treatment, as the degree of cold deformation increases.

Experimenters have found that metal sheets which are less than about 0.01 inch in thickness are very much more susceptible to the formation of coarse grains than when the thickness is greater. Their experiments were conducted with electro-deposited iron and the coarse grains formed while cooling from gamma to non-gamma iron. The reasons for the formation of coarse grains are, first, a temperature gradient, and, second, the thinness of the metal plates. These conditions will be recognized as ideal for the operation of the temperature-gradient law, since the progressive change of gamma to non-gamma iron would produce very small grain fragments and even a slight temperature gradient would be sufficient to cause selective growth.

The effect of thickness of section on grain growth is general in metals. The author has found that wires less than about 0.01 inch in diameter have two regions in which fast-grain growth takes place. One occurs at the ordinary germinative temperature. The other occurs at most any temperature above the germinative temperature, the time varying inversely as the temperature. In the second fast growth

range the large grains almost invariably first form near the surface of the sample. It is the writer's opinion that in such cases, where the ratio of the surface grains to the interior grains is large, the former, being unbalanced by having only one side in contact with adjacent grains, are readily absorbed by these interior adjacent grains. When the size of the surface grains due to this cause is enough greater than the equilibrium interior grains the latter are absorbed. The formation of large grains caused by small diameters of wires can be materially checked by the introduction of foreign bodies such as non-metallics. The practical effect of the introduction of non-metallics is to decrease the diameter of wire above which coarsening does not take place. In wires having a diameter of less than about 0.002 inch, it is doubtful whether the formation of grains extending across the diameter of the wire can be prevented by any means, provided the wire is exposed for a long time at a sufficiently high temperature.

Fast Growth Phenomena in Low-Carbon Steel

What has preceded in this paper has considerable bearing on the formation of coarse grains in low-carbon steel. The obstruction to grain growth offered by non-metallic globules is such that after the coalescence of the grains the globules do not change position, but the grains grow around them. Assuming the same to be the case with pearlite as the obstructing medium (although the ferrite of the pearlite may be divorced, leaving only the cementite as the obstructing medium), the fragments which form in the interior of an original grain of ferrite would not have obstructing bodies at their interior boundaries. In the first stages of selective grain growth the grain fragments, being small, would be absorbed readily one at a time and when the obstructing masses of pearlite were encountered grain growth would easily take place around them. As the grain fragments increase in size, their resistance to absorption becomes greater; hence, a point will be reached at which equilibrium exists. This is especially true when considering a definite time period.

On the other hand, as the large germinative grains grow at the expense of the small inert grains, the latter will have had more time to coalesce with one another as the time of sojourn in the germinative temperature range increases. It is well known that two adjacent grains which are not able to coalesce with each other in five minutes, might do so in five hours. Another factor which should not be lost sight of is that when a metal has been but slightly cold deformed, some of the adjacent grain fragments resulting may be in the same orientation and only be separated by a slip plane of amorphous metal. This amorphous material may be absorbed during heating by the crystalline metal, thus producing what is analogous to coalescence.

In very low carbon steels in which the mass of ferrite is much greater than that of the pearlite, there is considerable evidence that the pearlite does not change into the equilibrium percentage of austenite when heating above *Ac1*. Quenching experiments on samples which have been previously normalized, invariably show less martensite in the very low carbon steels than would be expected from the equilibrium diagram. When these

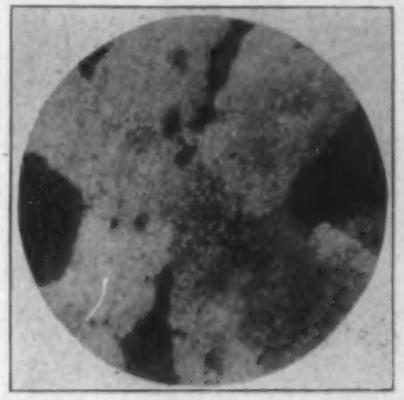

FIG. 4—THE SAME AS IN FIG. 3 WHEN ALL THE SMALL GRAINS HAVE BEEN ABSORBED—18 DIAMETERS

same steels are heated to very high temperature—1,200 to 1,300 degrees Cent.—larger percentages of martensite are formed. It is likely, therefore, that there is less austenite formed during the heating of these steels than would be expected from the equilibrium diagram. This is borne out by heating curves and by the occurrence of free cementite.

It is further probable that germinative grains which had reached considerable size below the *Ac1* point, would have greater power to divorce the ferrite from the pearlite than would smaller grains. Consequently, while the pearlite or austenite might easily prevent the small grains from coalescing with one another, the large germinative grains might have sufficient power to absorb the inert grains. This is precisely what does happen in the case of a pure metal mixed with about 10 per cent of its volume of a non-metallic material.

The suggestion, that about 13 per cent pearlite might easily offer sufficient mechanical obstruction to grain growth to completely defeat the selective action, is highly acceptable. Before leaving this phase of the subject, it would be interesting to consider the effect of the critical transformations in steel. If a piece of steel were heated by electric current to such a temperature that the inner portion were above the *A3* point and the outer portion below the *A3* point, a fast growth temperature condition should exist at the intersection of these two regions. Similarly, during cooling from above the *A3* point if the inner portion were kept above the transformation point and outer portion below, a fast growth temperature condition should exist at the boundary. By the proper regulation of the heating rate or the cooling rate either large austenite grains or large non-gamma iron grains should be formed.

The existence of gases in metals cannot be neglected as a factor in the resistance to grain growth. It would seem, however, that if gas globules were responsible for the obstruction of grain growth, their presence could be determined by the aid of the microscope using high magnifications. That gases in solution or mechanically entrapped in metals may greatly affect the annealing temperature after cold deformation has been conclusively demonstrated.

Effect of Cold Deformation on the Orientation of Original Grains

Prof. Howe's statement that the uniformity of orientation after cold deformation is greater within the individual original grains than between adjacent grains, is no doubt generally true. It must be considered, however, that in cold-deformed metals there is sufficient difference in orientation within the original grains to be the chief cause of recrystallization on annealing. That we do not always see these differences in orientation may be due to the fact that the diameter of individual grains in which we can study etching pits is usually not more than 0.0002 inch. This distance is so small that variations in orientation might easily escape even a close observation. Moreover, the longitudinal sections which are usually examined in deformed metals are the most conducive to similar etching tints.

An experiment will demonstrate the points in question very clearly. Small wires, 0.003 inch in diameter, were heat-treated in such a way that grains about ½ inch long were formed, each grain occupying the full section of the wire for that length. Pieces of this wire were bent sharply through an angle of about 90 degrees in such a manner that the two ends of a sin-

gle grain were not internally deformed. In other words, all of the deformation due to bending was confined to a small area near the center of an individual grain. It is obvious that the two ends of the grain in question now have decidedly different orientations. The exact angle of difference is known, namely, 90 degrees. It is obvious that there is no sharp line of demarcation at the bend. The change in orientation is progressive. When a sample like the above is examined under the microscope, the etching tint is usually quite uniform. However, if the same sample be subjected to a twisting operation, the orientation has been changed with respect to different axes, and the etching tint does not remain uniform. Fig. 5 (750 diameters) is a photo-

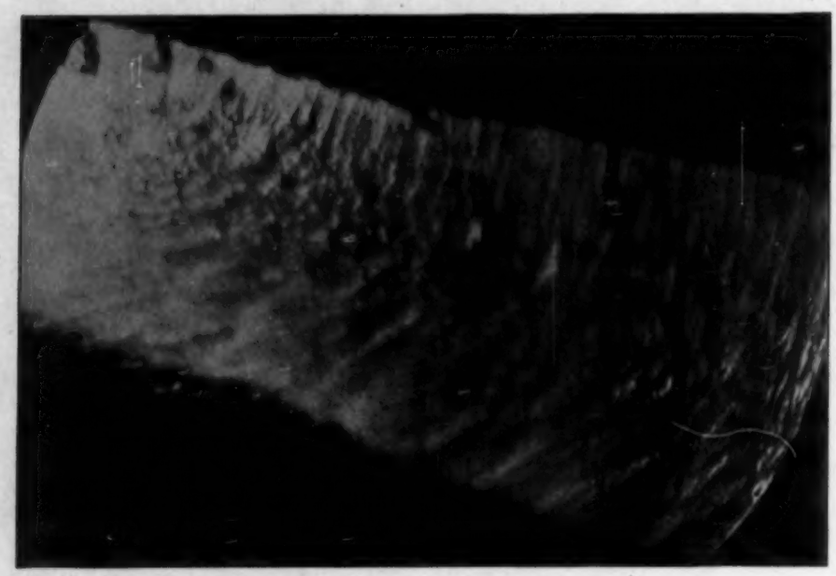

FIG. 5—A SINGLE GRAIN, TWISTED COLD, SHOWS DIFFERENCES IN ETCHING TINT—750 DIAMETERS

micrograph of a sample of wire so twisted. The differences in etching tint can be readily seen. The recrystallization properties in the bent sample are approximately the same as those in the twisted sample.

Recrystallization of Cold-Deformed Metals

No explanation of the recrystallization of cold-deformed metals on annealing has been forthcoming which did not assume a change in orientation within the initial grains due to the deformation. Some have tried to explain the formation of the new grains by assuming that the amorphous material forms nuclei for the new grains. The study of saturated liquid solutions in the presence of the solid solute teaches us that the solute in the crystalline state, and not the solute or solvent in the amorphous (dissolved) state, is the controling factor governing saturation equilibrium. As an example, if a solution of sodium chloride in water is saturated at a certain temperature with no crystalline sodium chloride present, the dissolved salt contains a certain amount of potential energy. This potential energy is not changed in quantity by the addition of a sodium chloride crystal to the solution, but some of the dissolved salt crystallizes and the degree of concentration in the solution is lowered. The force necessary to change this degree of concentration must be looked for in the crystal of sodium chloride. In the presence of amorphous and crystalline metal, therefore, the crystalline fragments and not the amorphous layers will be the controlling factors in recrystallization.

This experiment has been demonstrated by G. T. Beilby and is so basic in its general relationship to recrystallization that it should be repeated here in his own words. "Experiments have been made on the building up of an entirely amorphous mass of gold. Gold was precipitated from a solution of the chloride as a spongy brown powder. The washed and dried powder was compressed in a die after the gases it had contained had been pumped off at a temperature of about 150 degrees Cent. The pressure was applied by a small hydraulic press. This pressure was so great that the gold plug made a depression in the bottom plate of the die, which was of tool steel. The pressure must have been 60 to 80 tons per square inch. The gold squirted very slightly through a hole in the bottom plate, and also between the plunger and the sides of the die. The squirted gold was very hard and rather brittle, quite unlike pure gold prepared in any other way. The specific gravity of the compressed plug was 19.05, or rather lower than the specific gravity of gold. Its microstructure was granular and slightly spongy. This amorphous gold was certainly very much more rigid than even the hardest of cold-worked gold; it was almost devoid of plasticity. Another plug of compressed gold was made from the same powder, but a tiny spiral of very fine soft wire was dropped into the die before it was packed with powder. When a very moderate pressure was reached the soft gold squirted quite freely past the plunger, leaving the plug of hard gold behind.

The first compressed plug was heated to 350 degrees Cent. and showed no development of crystallization. In the absence of crystalline nuclei the amorphous form is stable even at this temperature. The squirted metal from the second plug which did contain nuclei crystallized freely at 350 degrees Cent.

Nitrogen Causes Brittleness

The idea that nitrogen is a deleterious element either in the form of the occluded gas or as a nitride is one that has become rather firmly fixed in the minds of many metallurgists. This view is sound if cognizance is taken of the knowledge furnished by experimental evidence and that gleaned from the apparently trustworthy literature on the subject. Nitrogen induces brittleness in both iron and steel in a manner as yet not clearly understood.

Bessemer steel is more brittle than open-hearth steel of similar analysis, regardless of the subsequent working and heat treatment. This is supposed to be caused by the large volume of air blown into the converter in the process of manufacture of the bessemer product, thereby exposing the metal to the nitrogen therein. In order to incorporate nitrogen into iron or steel for the purpose of experiment, a convenient method is to expose the test piece to the action of ammonia gas, NH_3, at high temperature. Iron and steel begin to take up nitrogen at about 400 degrees Cent., the action is most marked between 600 and 700 degrees Cent., and ceases at about 800 degrees Cent. With high nitrogen content, say up to 7 per cent, the metal so contaminated can be broken in the fingers.

The rolling mill at Hyde City, Pa., has been acquired by a syndicate of capitalists headed by Dr. C. F. Hennig, of Bellefonte. The plant now is being materially enlarged and will be operated on a more extensive scale.

A Real Foundation for Preparedness

The Experience Gained by American Manufacturers Who Are Making Shells for Belligerents Promises to be a Tremendous Asset in Strengthening Our Resources for Self Defense

SEVERAL months ago the senate appointed a board to investigate the advisability of manufacturing munitions of war exclusively in government plants. After spending several thousand dollars, the board has come to the obvious conclusion that such a course would be sheer folly. This conclusion was inevitable. Nevertheless it would hardly be fair to state that the expense of the investigation was entirely wasted, for the board has uncovered a number of startling facts regarding our lack of industrial preparedness that may at least cause a few pacifist mollycoddles to change their point of view.

A brief summary of the board's fiindings appears on page 254. These conclusions are not only highly important in pointing the way to real preparedness but also are of unusual interest in emphasizing the importance of our industries in the plans for preparedness.

The members of the board visited the several arsenals and the private plants of the following companies: Bausch & Lomb Optical Co., Rochester, N. Y.; Bethlehem Steel Co., South Bethlehem, Pa.; Colt's Patent Fire Arms Mfg .Co., Hartford, Conn.; Remington Arms-Union Metallic Cartridge Co., Illion, N. Y.; Savage Arms Co., Utica, N. Y.; Winchester Repeating Arms Co., New Haven, Conn.; American & British Ordnance Co., Bridgeport, Conn.; Midvale Steel & Ordnance Co., Philadelphia, and the Root & Van Dervoort Engineering Co., East Moline, Ill. The information obtained from the arsenal and plant inspections was amplified by conferences with representatives of the following companies: Allis-Chalmers Mfg. Co., Milwaukee; American Radiator Co., Chicago; American Locomotive Co., New York; Brown & Sharpe Mfg. Co., Providence, R. I.; Cincinnati Milling Machine Co., Cincinnati; DuPont Powder Co., Wilmington, Del.; General Electric Co., Schenectady, N. Y.; Greenfield Tap & Die Corporation, Greenfield, Mass.; Remington Arms-Union Metallic Cartridge Co., Ilion, N. Y., and the Winchester Repeating Arms Co., New Haven, Conn.

Brig. Gen. William Crozier, chief of ordnance, war department; Howard E. Coffin, of the naval consulting board, and of the advisory commission of the council of national defense, and E. S. Stettinius, a member of the firm of J. P. Morgan & Co., also appeared before the board.

Taking up the comparative cost of government and private manufacture of munitions, the report shows how the former is calculated, and states, that with few exceptions, the government cost is less than the corresponding purchase price.

"The result should cause no surprise," the board points out. "Indeed had a contrary state of facts been shown, a grave indictment of the government plants would have resulted; for, considering the question abstractly, it appears at once that the government cost should be less, and considerably less, as a general rule, than the private manufacturer's price, and this without any imputation upon the efficiency or the business policy of the latter. The government has no selling expense; it carries no insurance, but merely pays its fire and accident losses at their actual cost, estimated at about 0.3 per cent; its borrowing ability, as related to the cost of its investment, is exercised at a much lower interest rate; it has the advantage of long-continued experience in a few specialized lines and, finally, it makes no profit. In all these particulars, it has the advantage of the private owner and its costs therefore should be appreciably less than the private manufacturer's selling price, unless, as might happen, some exceptional advantage may, in a particular case, overbalance the conditions enumerated."

Based upon an estimate made by General Crozier, it is shown that extensions to government plants, sufficient to meet immediate peace needs and to accumulate slowly a reserve for 1,000,000 men, will cost $2,000,000. A second estimate, which covers the additional government plants needed to meet our war needs without calling upon private manufacturers, is based upon the requirements of 1,000,000 men in the first year and provides for the speedy outfitting of a second army of 1,000,000 men. This estimate calls for $496,000,000; a third plan provides for outfitting 3,000,000 men in addition to the original army of 1,000,000. This plan calls for additions to the existing arsenals to cost $937,000,000. The second and third estimates will continue indefinitely to supply the needs of the forces named (2,000,000 and 4,000,000 men respectively) and will also meet the anticipated needs for sea coast defense. These estimates are based on a one-shift plan, and do not include the price of new sites.

Many articles, such as rifles, have not been purchased nor priced by the government in the past four years, so it is impracticable to state with any degree of accuracy what saving the government has made during that period by manufacturing such munitions. The chief of ordnance, however, has compiled a statement showing the saving on articles that were both manufactured and purchased during the past four years. This statement covers articles costing $9,397,737.40 out of a total of $35,105,523.00 manufactured by the government at its arsenals. It indicates that these same articles, if bought at prices paid for such similar articles, would have cost the government $11,153,593.42. The estimated saving to the government was $1,755,856.02. Of this, about $680,000 represents the cost of inspection. By applying the same percentage of saving, 18.6 per cent, to the entire arsenal products for the four years, the saving would be about $6,500,000, of which about $2,525,000 represents the cost of inspection. This estimate, as the report says, must be understood to be a simple deduction, of uncertain value.

"This saving shows that the private manufacturer has added, on the average, about 11 per cent to represent his profit," the board explains. "It is plain that articles, for which special machinery has to be installed and

The Men Who Served on Senate Board

F. J. Kernan, President
Colonel, 28th infantry.

C. P. Summerall
Lieutenant colonel, field artillery

Benedict Crowell
Cleveland

R. Goodwyn Rhett
Charleston, S. C.

L. M. Fuller, Recorder
Major, U. S. A., retired

perhaps special buildings erected, if purchased sporadically, cannot be obtained at very close prices. Sound business practice would make it imperative to include in the cost a large depreciation charge. If continuous orders were assured, this charge would necessarily be reduced considerably. Any plan of co-operation to that end would not only result in a saving to the government, but it would co-ordinate an organization that would be of the utmost importance in time of trouble."

If a serious war is impossible, then the present supply of arms, munitions and equipment is not only sufficient, the board says, but more than sufficient for our needs. But if a great war would be thrust upon the country, the board warns that, "No student of our present condition can fail to see that we are far indeed from that degree of preparation which could protect us from at least temporary defeat and disaster at the hands of any enemy which might overcome our navy. The board therefore proceeds to its conclusions on the assumption that the country may find itself—perhaps in the near future—confronted with war on a large scale. On that assumption, the question of "how may we best provide ourselves with the indispensable material with which to begin an effective defense, as well as to maintain it?" looms large, and is given a full discussion.

The report takes up the question of supplying arms, ammunition and equipment exclusively through government plants and considers the highest estimate submitted by General Crozier. "The estimates given are approximations only—and necessarily so," the board points out. "But for our purpose it is immaterial whether the sum required is $927,000,000 or $1,000,000,000 or $800,000,000. In any event, the sum is enormous. The plants erected would be in a large part idle in the years of peace and deteriorating with each year. At the same time, they would be each year passing, in more or less degree, into the category of the obsolete; that is, becoming a dead loss. This results from two facts: First, their output has no commercial market in peace times; second, their capacity far exceeds the public requirements in these same peace times. Moreover, the most important factor is wanting, that is, the organizations. It takes more time and money to acquire these organizations than any other element of manufacture. If no other plan could be found, a reasonable man might be driven to advocate it as the only way to insure against a great national calamity. But other ways are open, ways by which productive capital will not be locked up in complete idleness but which will still hold the country in readiness against the critical day.

"Those who have studied attentively the history of this country in its past wars have been moved to say that in our day of need a benevolent Providence has stood between us and our peril. Today, without conscious effort to that end, a situation has developed through which, if we regard the immediate future as charged with danger, we may also see the workings of that same Providence. Two things have happened, or are in process of development, which go far to insure the safety of the United States, provided only that advantage be taken of them: First, the people have been aroused from their dreams of unbroken peace by the appalling European war so suddenly begun and waged with such unexampled energy, so that a national alertness upon this question of national defense now exists which 30 months ago had no being; second, the demands of the foreign combatants for arms and ammunition have developed in this country a capacity to make these munitions in a thousandfold greater quantity than was dreamed of in July, 1914. The coincidence of these two developments, that is, the vision to see our possible danger and the capacity to prepare against it, is remarkable and constitutes an asset of tremendous value to the country. But it needs to be taken advantage of. It is an opportunity of greatest magnitude; but still only an opportunity. It is potential, not actual, military strength, and with the passing of these European conditions which gave it birth, it will begin to dissipate unless conserved by being put to use now or in the near future. Therefore, it seems to this board that prompt advantage should be taken of the peculiar conditions that now exist before that munition-making capacity is destroyed by the scrapping or exporting of the machinery, which, with the organized personnel constitutes the essence of it."

Exclusive government manufacture is impossible, it is stated, not only because of the enormous capital locked up and wasted through the non-use and deterioration of a large portion

A Definite Policy for National Defense

IT is not desirable that the government manufacture its arms, munitions, and equipment exclusively.

It is not feasible or practicable for it to do so with any due regard to economy or to preparedness within a reasonable time.

It is desirable that the Rock Island arsenal be enlarged promptly and considerably, especially for the increased production of rifles.

It is desirable that modern machinery and appliances be installed in all arsenals where needed.

It is desirable to arrange with private industries for a portion of the supply of whatever reserves of arms, munitions, and equipment are determined upon with due regard to the conversion of their plants to use in such connection in time of war.

It is important to take into consideration the location as well as the organization of plants which are co-ordinated, with a view both to safety and facilities for distribution.

It is important to accumulate at least a year's supply of all raw material which is needed in the manufacture of arms, munitions, and equipment and is not to be found anywhere within continental United States.

It is important to accumulate a full supply of drawings and gages sufficient to enable all co-ordinated industries to work to full capacity promptly.

It is desirable to standardize gages, jigs, and tools as far as practicable and as soon as practicable.

It is exceedingly important that skilled and experienced labor, in co-ordinated industries especially, be enrolled, and in the event of war enlisted for work in selected factories.

It is important that a comprehensive plan of organization for prompt expansion to full capacity, night and day, both in government plants and in those of co-ordinated private industries be worked out and made ready for immediate use.

It is important that the government establish plants for the assemblage of field-gun ammunition at such points as may be best adapted thereto, with due regard to safety and facility for distribution.

It is exceedingly important that our arsenals equipped for the manufacture of rifles and artillery be put to work at full capacity as early as possible.

of the plants during peace years, but more strongly still because such a plan spells delays—and long delays—which in turn may spell disaster. The report asserts that the country cannot fail to recognize the period succeeding the present European war as one fraught with much difficulty and danger, and, to insure against it, advantage of the present opportunity must be taken promptly and vigorously.

The expenditure of $52,000,000, it is pointed out, would enable existing arsenals to take care of current peace needs, while building up, through a long term of years, a reserve of arms, ammunition and equipment, for 1,000,000 men and for the field artillery called for by the Treat board's approved program and for certain additional sea coast arms and armament.

"If carried out as a policy, this plan would work evil in two comprehensive ways," say the report. "First, it makes no provision for supplying the necessary increased demands when war comes, but leaves the very essentials of genuine preparedness to be improvised when war is upon us. Second, it destroys the capacity of all private plants to give assistance to the government; a capacity now large, organized, and efficient because of its development through the European war at no cost to our government.

"From the foregoing considerations it appears to the board impossible to escape the conclusion that it is not desirable for the government to undertake, unaided by private plants, to provide for its needs in arms, munitions and equipment. Nor is it feasible or practicable to do so in any sense except in the restricted sense of a mere physical possibility."

The board recommends enlargement of the Rock Island arsenal. The increased capacity of powder plants must be preserved for the sole powder plant owned by the war department, the Picatinny, near Dover, Del., has a capacity of but 11,000 pounds per day. One of the sea coast fortifications, it is asserted, could fire its daily product in a minute.

The great guns for sea coast defense, their carriages and their emplacements, it is stated, must be in place and in readiness with the necessary reserves of ammunition when war begins. Among other things it is shown that 114 guns and mortars, nearly all of large caliber, are still needed to complete projects for sea coast fortifications. It is pointed out in this connection that the arsenal at Watervliet, N. Y., where large ordnance is manufactured, is not running at capacity.

"Of all the continuing requirements of mobile forces in time of war," the report says, "the field artillery guns and carriages and the infantry rifle present the most difficult problem, because of the time unavoidably consumed in their making.

The Springfield rifle, it is stated, has more than 100 parts. More than 1,400 distinct factory operations are required to produce the finished piece. The experience of the country's most highly organized and best equipped plants in carrying out European orders for military rifles is held to be a lesson that this government should take to heart. The lack of correct specifications and drawings, it is declared, accompanied by the lack of correct gages, jigs, special fixtures, and tools not merely caused delay in arriving at a satisfactory output, but caused a large waste of time and labor upon unsatisfactory products. The plants that are now turning out foreign rifles have not yet reached their expected capacities. The shifting of these private plants from the manufacture of European rifles to the manufacture of Springfield rifles, if undertaken today, the board finds, would require not less than 18 months to get first results and at least two years to get capacity output.

There are now five plants manufacturing military rifles in this country. None is equipped to manufacture the Springfield rifle. The cost of the necessary gages, jigs, etc., it is stated, seems to be about 20 per cent of the total cost of the plant. These private plants are not well located either with respect to safety or convenience.

"This problem is not only a difficult, but a vital one, and the board is impressed with the importance of its early solution," the report adds. "It may be that the government will find it essential to increase its facilities for the manufactured rifle considerably in order to be in a position to supply the wastage which occurs in the first year of war, and to equip such additional troops as may be raised and are not provided for in the reserve."

Field Artillery Needed

A similar story, the report says, can be told of the production of field artillery, except, that in the case of the larger guns, a still longer time is required. The board says it cannot too strongly emphasize the alarming shortage of rifles and field artillery and the impossibility of filling this need in time of emergency. It is absolutely essential, in the judgment of the board, that immediate steps be taken to procure the necessary rifles and field guns of appropriate caliber. Without this, the board points out, no defense can be made effective. The time necessary for their manufacture under ordinary conditions is so great that it not only may prove fatal, but, in the judgment of the board, it is the weakest link in the chain of our country's military defense.

The board urges standardization and storage of gages, etc., and suggests that a committee on standardization be appointed. It suggests that one army officer, one naval officer and a civilian engineer appointed by the council of national defense form such a committee. This plan offers a way by which the initial and greatest difficulty in the private manufacture of war munitions can be minimized.

Turning to the subject of the attitude of the private manufacturers toward preparedness, the board points out that the enormous difficulties these manufacturers have experienced before achieving success in filling foreign orders, combined with the extraordinary size of the foreign demand has created a lasting impression that the carrying on of modern war is a task of stupendous magnitude and of extreme difficulty.

"They are more than willing to cooperate," says the board, "they are anxious to do so, fully realizing that in successful co-operation with the government lies the best if not the only certain chance of success. Apprehension has been expressed that government contracts and a potential capacity to turn out war material might foster the growth of a class whose profitable interests lie in war, and who, in consequence, might in time become a danger to the state. It is not the belief of this board that any such danger exists in our country. The number of plants and of persons concerned, when considered in reference to the whole country, the total of industrial plants and of people, is relatively too insignificant.

"We found the feeling prevalent that the outbreak of any hostilities would be the signal for the government to take practical possession of such private plants as were prepared to manufacture arms and cut all of the profits out of war." Indeed the board could see no way in which these manufacturers could hope to derive any benefits from war in which this country is involved. On the contrary, they realized that their industries, in such an event, would have to cease and their plants would be turned over to the government upon whatever terms it would choose to fix. Domestic peace, not war, offers them the occasion for profit."

In conclusion, the board says it seems imperative that the government must decide upon some policy with

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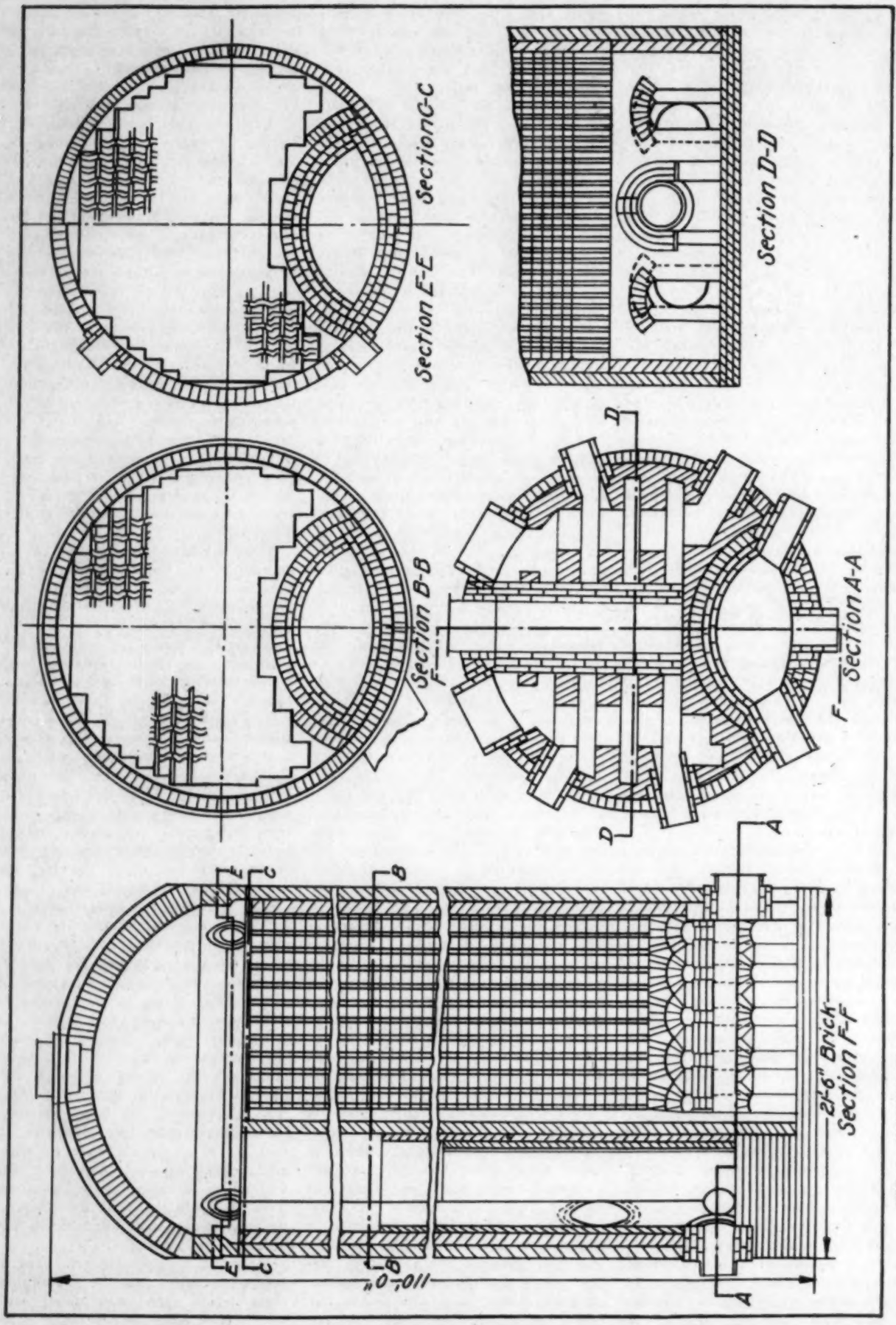


FIG. 7—CONSTRUCTION OF A TWO-PASS STOVE, SHOWING USE OF CORRUGATED CHECKERS AT JOLIET WORKS OF THE ILLINOIS STEEL CO.

Modern Hot-Blast Stove Design—III

The Tendency in Recent Development Has Been to Increase the Capacity of the Stove Units and to Reduce Their Number—The Three-Stove Layout is Elastic

BY ARTHUR J. BOYNTON

COMPLETE tests made on the stoves give a thermal efficiency of 71.58 per cent with an average blast temperature of 1,119 degrees Fahr. and 44,748 cubic feet of air per minute.

Two-pass side-combustion stoves were also built at the Joliet works. On a relatively small furnace blowing about 30,000 cubic feet of air per minute three stoves have furnished blast temperatures up to 1,200 degrees Fahr., with stack temperature less than 600 degrees.

A method of relining old stoves with small checkers is practiced at the South works of the Illinois Steel Co. These stoves are of recent construction and are not fully in operation. Three stoves per furnace are expected to furnish a blast temperature up to 1,300 degrees Fahr. with a high degree of efficiency.

The third and last installment of the paper, "Progress in Hot-Blast Stove Design," presented at the recent St. Louis meeting of the American Iron and Steel Institute. The original paper has been revised by the author, who is superintendent of blast furnaces, National Tube Co., Lorain, O.

New stoves have also been built by the United Furnace Co. and by the Inland Steel Co. Three stoves per furnace are provided by both companies. These are recent installations not yet in operation.

The use of corrugated checkers in a two-pass side-combustion stove is shown in Fig. 7, which illustrates the construction employed on one stove at the Joliet works. The economy of use of these checkers is referred to above.

Efficiency of Two-Pass Stoves

Two-pass center-combustion stoves have recently been built by the Carnegie Steel Co. at Duquesne, by the Illinois Steel Co. at Joliet and by the Gary works of the Indiana Steel Co. Test of the performance of this stove on a basis of four stoves per furnace show a thermal efficiency of 70.3 per cent when heating 48,555 cubic feet of air per minute to a temperature of 1,420 degrees Fahr.

New stoves now under construction at the Gary works are shown in Figs. 8 and 9. Four stoves are being provided per furnace. All of these stoves show great care on the part of the designers in providing for distribution of gas to the chimney valve.

Three-pass stoves are exemplified by recent construction of Corrigan, McKinney & Co. at their river furnaces, Cleveland, O., and by rebuilt three-pass stoves at the south works of the Illinois Steel Co.

The Corrigan, McKinney & Co. stove represents standard three-pass stove construction modified by reduction in the size of the checkers. These stoves are built four per furnace. The rebuilt three-pass stoves at the South works show the application of square checkers in the second pass to a three-pass stove. Four of these stoves are provided per furnace. Very high blast temperatures have been obtained from both these designs of three-pass stoves, but data as to thermal efficiency are lacking.

Excepting the first, all of these designs of stoves are interesting chiefly in their details. The new stoves at Joliet, however, represent an increase to

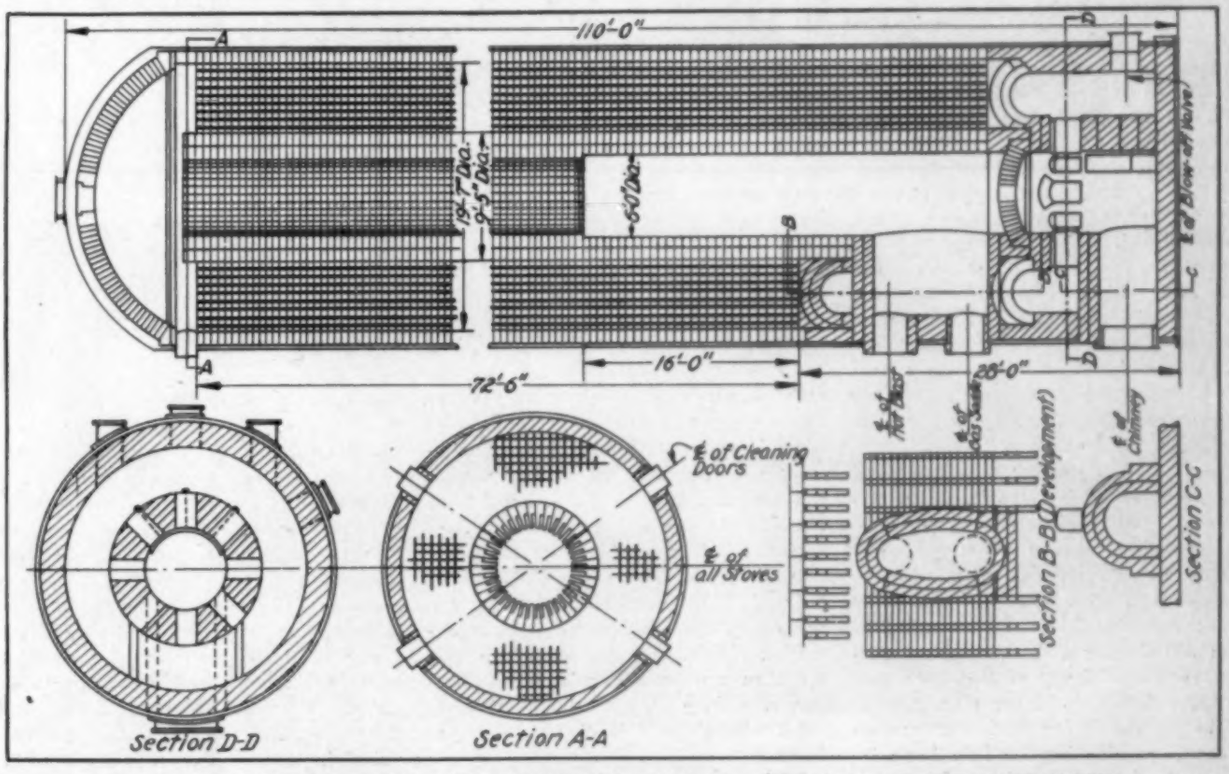


FIG. 8—SECTIONAL ELEVATION OF NEW STOVES UNDER CONSTRUCTION AT THE GARY WORKS

a size of stove not heretofore operated together with some novel features of design. The present stoves are rebuilt inside a shell 25 x 100 feet in height, are four-pass stoves having a 6-foot diameter circular side-combustion chamber, a fourth pass opposite the combustion chamber with the second pass occupying one side of the stove and the third pass the other. Advantage has been taken of the lessened temperature by reducing the size of the checkers in each successive pass after the second, the idea being not only that the volume and velocity of the gases is decreased, but that the service of the brick will be less severe. The second pass is built of 2-inch brick with 4½-inch square openings; the third pass of 2-inch brick with 3½-inch square openings and the fourth pass of 1½-inch brick with 3-inch openings. The second pass contains 362 checkers, the third 492 and the fourth 490, the areas in the passes being, first, 26¼ square feet; second, 51 square feet; third, 41 square feet, and fourth, 30 square feet. The total heating surface is 128,500 square feet.

One of these stoves is capable of heating 40,000 cubic feet of air per minute to 1,300 degrees Fahr. for two hours, with a heating period of equal length, two stoves being sufficient to heat blast at this rate. The chimney temperature for this performance is less than 300 degrees Fahr. and the apparent thermal efficiency of the stove neglecting radiation is 92 per cent.

The necessity for fuel conservation which is manifesting itself in large investments for gas engines, for waste heat boilers operated by the waste gases both from gas engines and from open-hearth furnaces, and for the fullest use of the gas from coke ovens, is equally urgent in compelling not only the use of high blast temperatures, but the greatest possible economy in their generation. The heat actually transmitted to the blast of a modern furnace is about the same as that transmitted to the water in a boiler plant generating 1,500 boiler horsepower. The same reasoning which has required higher efficiency of the boiler, and which has in some cases condemned the steam plant for lack of efficiency, will require the highest practicable efficiency from the hot blast stove.

All available data point to the conclusion that a given heating surface is best arranged both for heat and for economy when grouped in the fewest practicable units of large size. The chief argument for four stoves is the lessened interruption to operation if a stove goes out of service. On the other hand, with only two stoves the furnace shuts down if one stove goes out of service, and a two-stove equipment will not come for many years, if it comes at all. The three-stove layout, however, is elastic enough to prevent severe crippling of the furnace operation when one stove comes off, particularly if it is practicable to force the remaining stove, and in all respects excepting elasticity in operation it is better than an outfit consisting of four stoves. There is, accordingly, a present tendency to build three stoves per furnace.

With regard to the size of the units, the information at hand seems to indicate that a heating surface of 100,000 square feet per stove for three stoves is sufficient for all purposes, although this is necessarily a tentative figure. Such a surface can be contained within a stove of reasonable proportions with any checker sizes now in use, and of ordinary dimensions if the smaller sizes are employed.

There is no present conclusive reason for advocating one type of stove over another. Two-pass stoves will continue in favor on account of their mechanical simplicity, unless the advantage of length of pass and increased velocity of air and gas in the stove as exemplified in the Joliet installation prove a conclusive reason for changing to a greater number of passes. There are at present no data on which to base a prediction in this regard.

The same uncertainty exists as to the relative advantage of increased height or increased diameter in a two-pass stove. From the standpoint of first cost based on economical use of materials and of space inside the shell, the advantage is in favor of larger diameter. It is improbable that height will be reduced, but any considerable increase in height will require the same reasons that would apply in favor of a four-pass stove.

Recent development may therefore be said to have taken form to date in increase in the capacity of units, and a reduction in their number ,together with the application of scientific methods to their operation. Blast furnace men are united in looking upon this development as a most promising one for the improvement of metallurgical practice.

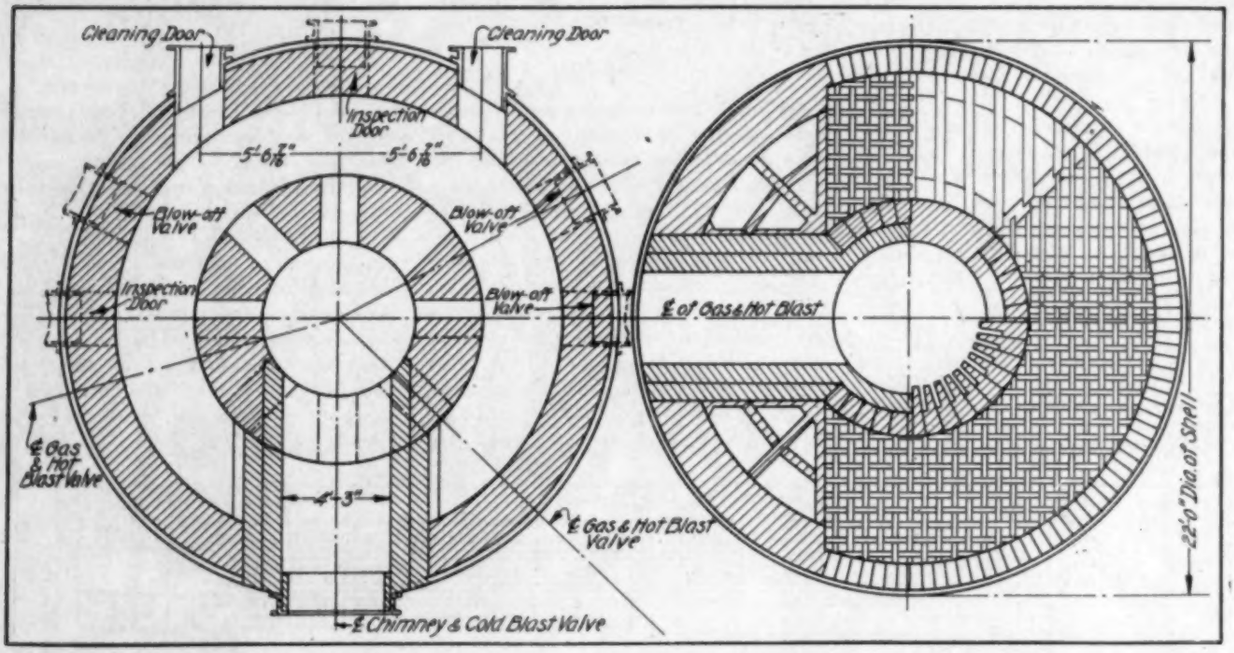


FIG. 9—CROSS SECTIONS OF NEW STOVES UNDER CONSTRUCTION AT THE GARY WORKS

Fig. 1—Showing the Fluxing Effect of Alkali Fume on Second-Pass Checkers

Progress in Hot-Blast Stove Design

BY R. J. WYSOR

UNTIL very recently, as indicated in Arthur J. Boynton's paper, improvement in hot blast stove design lagged behind progress in construction of the furnace itself. A dual problem confronts the designers of hot blast stoves especially for modern blast furnace plants directly connected with steel works. On one hand, improved furnace lines and better conditioned stock have permitted the use of higher blast heats, while on the other, the demand for gas for engines and boilers has become increasingly insistent. In brief, the present desired function of the stove is to produce more heat with less gas consumption. To meet this demand, the active co-operation of the combustion engineer and the mechanical engineer is required, the solution requiring both expert theoretical and practical knowledge.

The first half of the problem was solved at Bethlehem years ago by the construction of a battery of five standard three-pass stoves, using washed gas. The hard eastern and foreign magnetite ores, which have always constituted the bulk of Bethlehem ore mixtures, permit the use of the highest blast heats which practically can be attained. The "straight line" hot blast temperature, in normal practice will average about 1,400 degrees Fahr.

The question of insulation of stoves and hot blast system, almost unheard of until about two years ago, is now receiving the attention it deserves. Preventing the loss of 5 to 10 per cent of the heat developed, or what is more to the point, conserving the peak of the temperature curves, is a

A discussion of the paper of Arthur J. Boynton, "Modern Hot-Blast Stove Design," appearing in the Jan. 11, Jan. 18, and Jan. 25, issues of *The Iron Trade Review*. The author is superintendent of blast furnaces, Bethlehem Steel Co.

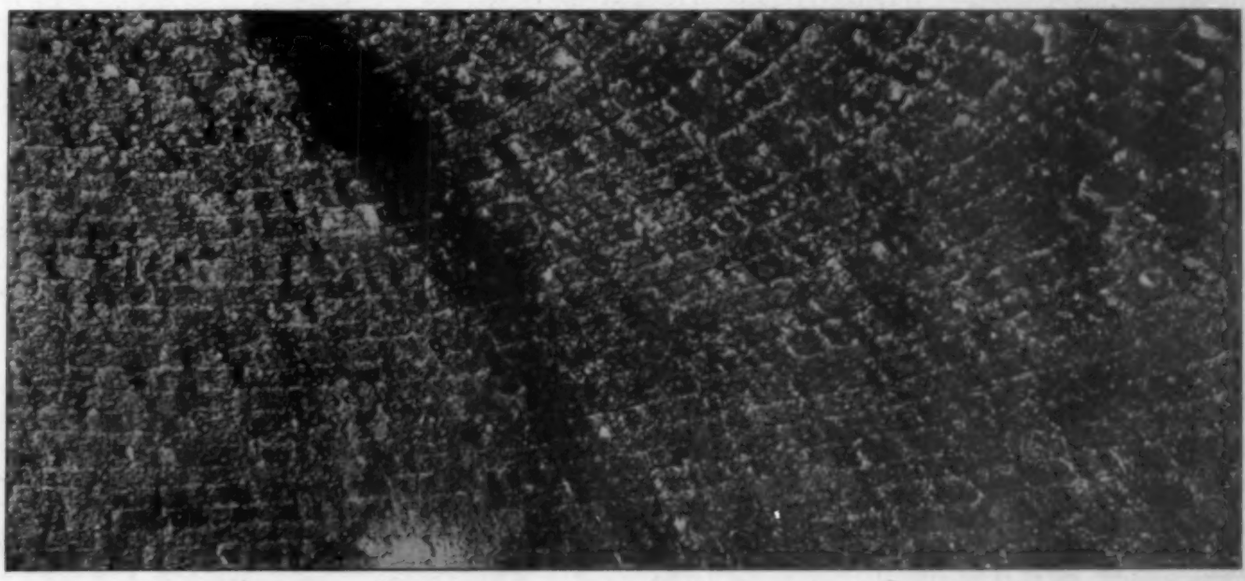


FIG. 2—HONEYCOMBING OF THE LOWER SURFACE OF THE DOME IN A HOT-BLAST STOVE

strike for efficiency of no small moment. About four years ago we began experimenting at Bethlehem with various materials for hot-blast main and stove insulation. At the first opportunity a section of a hot-blast main was insulated internally with a special brick, this being one of the earliest, if not the first, experiment of the kind in this country. At a new furnace, now being built, the four stoves, stove necks, hot blast main and bustle pipe are being insulated throughout the stoves, in part with packed diatomaceous earth alone, and in part with insulating brick, with insulating earth in the packing space for direct comparisons. The remainder of the hot blast system is insulated with manufactured kieselguhr brick.

Alkali Fume Scores Checkers

We are building four of these new stoves, of the same three-pass type, with small radial checkers, the minimum checker openings being approximately 4½ inches. The heating surface of these stoves will be about 81,000 square feet, an increase of over 50 per cent over the old stoves of the same external dimensions. One reason for not attempting still smaller checker openings is the fear of possible clogging of the openings, or destruction of the small brick by flue dust, in spite of good primary washers. In our practice an unusual quantity of fine fume, low in iron oxide but rich in alkali content is produced, which is imperfectly removed by ordinary wet washers. No comparative amount of such fume is produced anywhere in the west, except in the manufacture of ferro-manganese or spiegel. The alkalies in this dust will flux the surface or honeycomb the entire brick causing its disintegration. The fire clay joints are especially susceptible to attack. The combustion chamber, lower surface of the dome and upper checkers naturally bear the brunt of the action. The accompanying typical photographs, Figs. 1 and 2, show the effect on the dome and top of the second-pass checkers. To prevent this evil as far as possible in the new small checkered stoves we are installing an improved type of washer, and are using several high-temperature, alkaline-resisting cements instead of fire clay in the hotter parts of the stove.

Considerable attention is also being paid to the prevention of air leakage in old and new stoves. The vulnerable points in a stove and connections for escape of air blast are many and likely to be forgotten. Too much attention cannot be given to the bottom construction, as leakage is of an insidious nature and may not be discovered for a long time. The blast may escape through a cracked or burnt bottom plate, if not water cooled, or around the outer edge of the angles riveted to the bottom plate and lower ring of the shell if weak, or if joints have been improperly calked. Stove riveting should be a fine art, as leakage can often be detected around the rivet heads, and good calking of lapped edges is necessary. Clean-out doors require occasional attention. Blast leakage through cold-blast, hot-blast and chimney valves at times may be of unbelievable magnitude. Improvements in the construction of these valves, especially the chimney valve for the three-pass stove, which will insure perfect seating at all times, will be a boon to the blast furnace fraternity.

Mr. Boynton states that there is as yet no general tendency toward the use of forced draft for air or gas. It is my present opinion that for our condition at least, it is equally satisfactory and much less expensive to have an expert continually to look after stove efficiencies, and who will supervise the stove tenders than it is to employ more or less self-regulating induced-pressure burners. We are now pursuing this policy.

New Recording Thermometer

The Brown Instrument Co., Philadelphia, is making a new type of recording thermometer for temperatures up to 800 degrees Fahr. or 425 degrees Cent., which embraces a number of interesting features. This instrument operates on the principle of the expansion of gas with change in temperature. A bulb of copper containing nitrogen gas under pressure is connected to a recording instrument by a small copper tube protected by flexible steel tubing. The recording instrument has a helical spring somewhat similar to that used in pressure gages. The expansion of the gas in the bulbs exerts a pressure which is conveyed by the capillary tube to the helix, which expands in proportion to the pressure. This helix is directly connected to a recording arm which registers on the record chart. This type of instrument can be furnished with tubing as long as 100 feet, if required, so that the recording gage can be placed as far as 100 feet away from the point where the temperature is measured.

The Seth Thomas clock which revolves the chart is mounted directly on the front plate on which the chart revolves. This is said to insure alignment of the clock and chart plate. The clips which hold the chart in position are mounted on the door so that when the door is swung aside these clips are automatically swung away from the chart, permitting its easy replacement without interference. A device is also furnished which raises the chart pen from the chart automatically when the door is opened and frees the pen automatically when the door is closed. This instrument is also made so as to indicate the temperature on a dial instead of recording it on a chart. A number of different types of bulbs are supplied either with threaded connections for insertion in mains and pipes, or with lead coating to withstand chemicals and acids.

Invents Automatic Stoker

An automatic stoker designed to use powdered coal, and claimed to maintain a uniform speed, has been invented by Chas. I. Filson, Burnham, Pa. A hopper of gradually decreasing cross sectional area from top to bottom is enclosed at the latter end by a casing. To one end of this casing is attached a smaller housing, equipped with a removable bearing cap. A vertical plate, secured between the casing and the housing, is provided with a semi-circular opening extending above its center. The lower edge of this opening is provided with a recess for the accommodation of the conveyor shaft. The conveyor shaft is equipped with two sets of double spiral flight blades and a number of agitating rods journaled in bearings on either end. An adjustable plate, designed to regulate the feed is bolted on the plate between the casing and housing. The bolts are inserted in long slot holes, permitting the plate to be lowered and raised. In the end of the casing a short shaft, also mounted in a slot, is provided on its inner end with an arm, connected by means of a link to the vertically moving plate. This shaft is operated by a lever on the outside of the casing. It is apparent that when the vertically moving plate is in its lowermost position, the feed of the material from the casing to the conveyor flight is entirely cut off. By manipulating the lever, the plate may be elevated and lowered, respectively increasing and diminishing the coal opening. Vibrating blades, secured at their upper ends to the opposed inclined walls of the hopper are provided to insure a continuous feed of the coal when the latter is in a damp condition. These blades are pivotally connected by a link bar.

Potash From the Blast Furnace—II

The Recovery of Potash in Connection With the Thorough Dry Cleaning of Blast Furnace Gas is an Attractive Proposition for Plants Charging Burdens Rich in Alkalies

BY R. J. WYSOR

AT BETHLEHEM there is in service a type of tower spray washer, in common use in this country. All of the gas for stoves and boilers, as well as for gas engines, is washed, except from one furnace. Naturally, it would be thought that practically all of the alkaline material in the dust, most of it readily soluble in water, would be removed in the wet washers. The bulk of it is washed out, but it is a remarkable fact that much of the water-soluble alkalies remains in the gas current after leaving the washers. Calculations based on alkalies charged into the furnaces, lost in the slag, dust catcher, stack gases, etc., and recovered from the stoves and boiler settings, indicate that about 21 per cent of the total potash and apparently only about 5 per cent of the soda, entering the primary washers, passes through them. The explanation for this fact is that the particles of fume are in such an exceedingly fine state of division that they escape contact with the relatively large drops of water. Any washer which will successfully clean blast furnace gas rich in this fume must employ spray nozzles or other devices which will discharge water in a fine mist, thus insuring intimacy of contact between dust and water particles. Our washers at present perform the function of selective precipitation, eliminating the relatively coarse and heavy iron ore and coke particles, while delivering the lighter particles of dust and fume into the primary clean gas main.

Table V.

Weights and Water-Soluble Potash Contents of Alkaline Dust

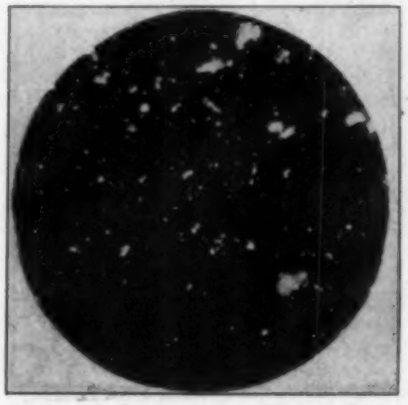
Weight of carloads in net tons.	Percentage water-soluble potash, K_2O.	Weight of carloads in net tons.	Percentage water-soluble potash, K_2O.
33.0	10.05	34.7	7.04
31.3	11.20	32.8	6.22
26.1	9.95	36.4	10.24
24.9	10.65	33.7	7.15
25.4	10.10	32.5	12.00
24.0	11.31	27.3	7.27
25.7	13.96	29.9	11.38
21.1	8.32	31.3	14.22
27.4	9.32	35.0	7.69
27.7	12.17	34.1	9.01
27.9	9.62	26.3	7.53
24.2	11.91	35.1	7.82
26.1	15.92	39.4	6.05
24.0	15.07	27.8	7.48
34.5	11.00	26.4	8.76
28.2	10.27	32.1	8.60
30.6	10.37	....	....
33.9	8.73	32.5	8.58
30.2	14.35		
		Total	Average
		1,073.5	9.90

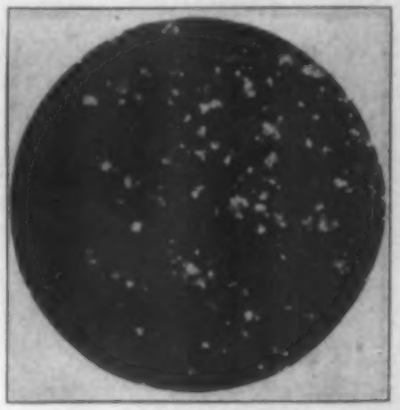
Total weight of water-soluable potash..... 106.3 net tons.

The mains carrying gas from the primary washers to stoves, boilers and secondary gas-cleaning plant accumulate dirt or mud gradually, and are washed out at intervals of every two or three months. This dirt is black when wet but after being dried is dark gray, and after the fine particles of coke dust are burned out, it is of a light-gray or reddish-white color. Sometimes drippings from a clean-out door along a gas main will form beautiful long stalactites. This material is in general appearance similar to the stalactites mentioned as exuding from the furnace shell. A typical sample of this material was found to have the following proximate composition, when analyzed: SiO_2, 0.28 per cent; Fe_2O_3 + Al_2O_3, 0.68; CaO, trace; MgO, 0.25; K_2O, 44.63; Na_2O, 7.13; Cl, 37.22; CO_2, 7.78; CN, trace; NH_4, none. The almost utter absence of cyanide in this concentrated alkaline material is worthy of note.

The dark wet dirt carried into the stoves, which at this plant are of the three-pass type, is dead burned, of course, the combustible or volatile constituents, etc., being ex-

The second and last installment of a paper to be read at the February meeting of the American Institute of Mining Engineers, New York. The author is superintendent of blast furnaces, Bethlehem Steel Co., South Bethlehem, Pa.





FIGS. 5, 6 AND 7—PHOTOMICROGRAPHS OF SAMPLE *A*, FINE FLUE DUST RECOVERED FROM STOVES

Table VI.

Analyses of Typical Carload Samples and a Rich Stove-Dust Sample

Constituent.	Per cent.	Per cent.	Per cent.	Per cent.
SiO_2	22.22	18.07	18.50	22.66
Fe_2O_3	15.24	11.25	2.31	2.30
MnO	0.67	0.67	0.75	0.79
Al_2O_3	11.58	11.04	11.22	11.60
TiO_2	0.06	0.05	trace	trace
CaO	11.69	12.22	13.14	12.49
MgO	7.35	8.49	12.35	6.76
ZnO	2.57	0.82	4.29	2.04
C	5.04	5.43	0.50	0.40
SO_3	6.35	6.13	7.60	10.80
CO_2	1.61	1.94	2.40	0.58
Cl	3.34	5.29	5.40	4.86
CN	none	none	none	none
CNO	none	none	none	none
CNS	none	none	none	none
NH_4	none	none	none	none
Total K_2O	10.87	14.40	16.94	19.71
Total Na_2O	3.74	7.30	7.06	7.34
Water-soluble K_2O	7.55	12.00	15.92	17.04
Water-soluble Na_2O	3.28	3.94	4.44	3.98
Ratio water-soluble to total K_2O	0.69	0.83	0.94	0.86
Ratio water-soluble to total Na_2O	0.88	0.54	0.63	0.54
Ratio total K_2O to total Na_2O	1:0.35	1:0.51	1:0.42	1:0.37

pelled. The residue, in the form of an impalpable powder, collects to some extent in the bottom of the combustion chambers, a relatively large amount gathers in the bottoms of the second and third pass checkers while the largest portion is carried out in the stack gases.

In the combustion chambers the dust frits together in friable masses. The accumulation is not great, the wells being cleaned out at intervals of about two months. However, the action on the brickwork is serious. All over the inner surface of the combustion-chamber walls, the lower surface of the dome, and the second pass checkers for a depth of several feet, a deep-green glaze is formed, or the brickwork is honeycombed. Along the fire-clay joints between the brick, the action is especially marked. Stove brick of a high silica content invariably glaze or slag, whereas those with a lower percentage of silica are more readily honeycombed or excoriated by the alkaline fume.

The thermal efficiency of the stoves is reduced, of course, by this glazing, erosive and honeycombing action, though repairs seldom have to be made during a furnace campaign.

The fine, light-colored dust, which accumulates in the bottom of the second and third passes, is the material of commercial interest to us. It is cleaned out at intervals of three or four months.

In the boiler houses the dust accumulates and is recovered every few days from the combustion chambers, from the passes and occasionally from the horizontal flues leading to the stacks. It becomes increasingly fine and richer in potash in its progress. The boiler tubes, of course, become coated with the dust and must be blown off.

The white fume continuously issuing from the top of the stove and boiler-house stacks is approximately of the same composition as that reclaimed in the last passes.

As previously indicated, the dust recovered from the combustion chambers and stoves and boilers is a light, friable sinter, whereas the larger amount reclaimed from the passes and flues is in an exceedingly fine state of division. When drawn out of the stoves or boiler settings hot, it runs almost like quicksilver, but it absorbs a certain amount of water readily, and becomes somewhat clammy and heavy.

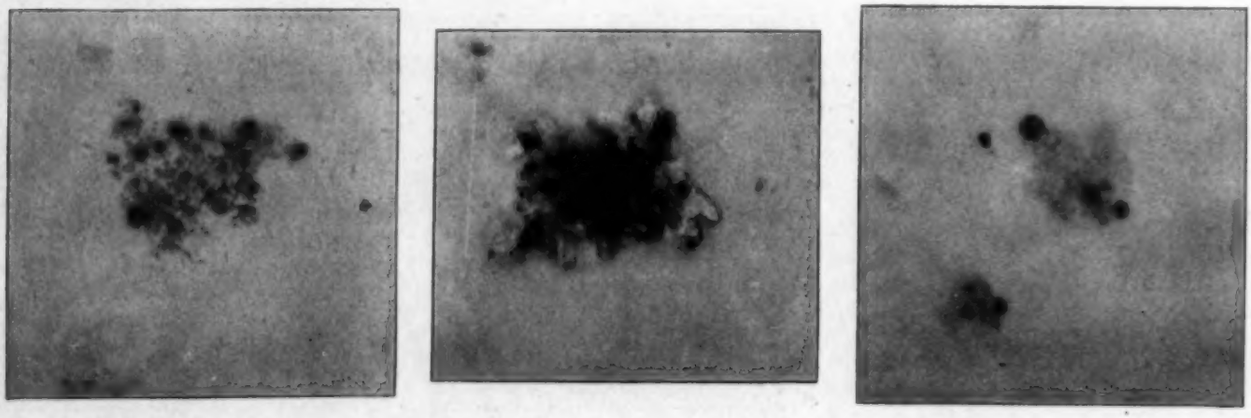
An attempt was made to obtain some data on angle of repose of the fine dust. However, the cold, freshly dried dust behaves very differently from the hot material. A large, glass funnel at a fixed height over a plane surface was employed in the experiment. Comparative tests with white sand and two kinds of ore, prepared to various degrees of fineness, down to ultra 100-mesh, all yielded heaps with angles of repose of about 40 degrees, whereas the stove-dust samples varied from 43 degrees to 50 degrees.

Sieve tests were also attempted. By careful sifting, it was found that all of the alkaline dust would pass a 300-mesh sieve. It is a true fume. The small residues remaining on the various sieves, when examined under a magnifying glass, were found to be chiefly eroded brickwork.

Specific gravity tests, also, cannot be made with accuracy. The lightest dust, without compression, will run well below 0.50 specific gravity. Samples taken from the checkerwork of five different stoves, and showing potash contents of 10 to 14 per cent, when tramped down gently in large glass measuring cylinders, showed the following varying densities: 0.68, 0.69, 0.73, 0.89, 0.96.

Three typical samples of fine stove dust were taken from different furnaces, and after being screened through a 300-mesh sieve and dried, were sent to an expert microscopist, skilled in examining such material. All of the samples showed the same characteristics, and nine typical micro-photographs are reproduced herewith together with quotations from the microscopist's report.

"The general characteristics in this dust are: Very fine, spherical particles; the large proportion of them as single particles, but many united into groups and held together as by a gelatinous



FIGS. 8, 9 AND 10—PHOTOMICROGRAPHS OF SAMPLE *B*, FINE FLUE DUST RECOVERED FROM STOVES

mass; the large majority of the particles are nucleated, the nuclei, however, varying greatly in size, as do the particles themselves; the nuclei may be several or but one in a particle, and are of a dark orange or brown color; the form of the particles is spherical to pearshaped, while the form of the nuclei is practically spherical. The nuclei are not always confined to the inner or central part of the particles, but may be on its surface.

"One photograph of each of the samples A, B and C was taken by means of a paraboloid dark ground illuminator, of approximately 500 diameters. They tell nothing of the detail of the individual particles but they do show clearly the grouping of the particles into aggregates of greatly varying sizes and forms. These aggregations are merely formed by the mutual attractions; that is, each particle is within the radius of attraction of the other. Photograph A shows particularly many single and individual particles, and represents a characteristic field of the samples. Photograph B shows a large group, or one of the largest groups, while photograph C represents smaller groups. It should be said that a larger group is reduced easily to smaller ones by agitation or stirring or crushing. No detail can be possible at this magnification."

"For detail, higher magnifications, with proper color screens and apochromatic lenses are essential." Difficulty was experienced with these lenses in getting all the particles in a group into focus. The greatest trouble, however, was in getting both the vitreous groundmass and the orange-brown nuclei to show up together. Under the circumstances the photographs are creditable and interesting.

Knowing the exceedingly fine state of division and smooth, spherical nature of the ultimate particles in this fine fume, there is little cause for wonder that so much of it passes through a creditable wet washer untouched.

The water-soluble potash content of the dry, ignited dust, recovered from the stoves and boilers, having previously passed through the wet washers, will vary from about 5 to 20 per cent. Our practice has been to store the material in a large bin, capable of holding two or three carloads. The commercial recovery, begun in 1914, was not thoroughly systematized until the ensuing spring. Table V shows the weights and water-soluble potash contents, calculated on the dry basis of 36 carloads, of alkaline dust shipped in the period of 15 months, April 1, 1915, to July 1, 1916. This represents all the dust removed from stoves and boilers serving for 500-ton furnaces, which could be recovered in normal operation, without special effort. Instead of being dumped into a dirt car, the dust was simply emptied into a central bin. A number of other carloads of lower-grade material, contaminated by flue dust from unwashed gas, were also shipped from the other furnaces, but are not included in this tabulation.

Complete analyses of three typical carload samples and one especially rich stove-dust sample, containing approximately 20 per cent watersoluble potash, are given in Table VI.

No readily volatile constituents, such as may occur in the unignited dust, of course, are to be found after roasting.

In general, the ratio of water-soluble to total potash is higher than in the case of soda.

The proponderance of both total and water-soluble potash over the corresponding soda determinations is impressive, showing the much greater removal of the latter in the wet washers, or its greater volatility, in which case it would be carried out of the stacks in greater quantity.

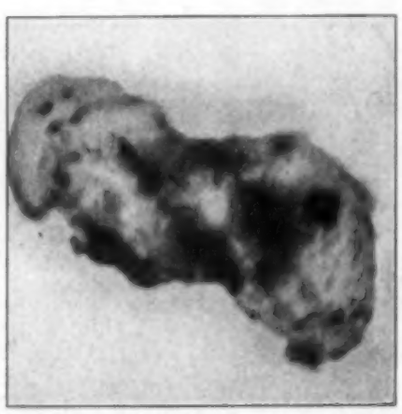
If we assume that the total soda content in the stove and boiler dust averages 40 per cent of the total potash content, and the water-soluble potash 80 per cent of the total potash, as appears reasonable from the foregoing analyses, then the total alkalies recovered in the fertilizer material in the above period is found to be: Total potash, 118 gross tons; and total soda 47 gross tons.

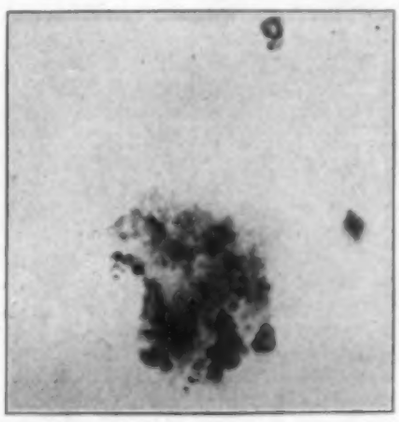
Calculating on the basis of pig iron produced in the above 15-month period, the alkalies recovered in terms of total charged are as follows: Total potash recovered in fertilizer material, 0.3 pounds per ton of pig, or 1.3 per cent of the total charged; total soda recovered in fertilizer material, 0.1 pound per ton

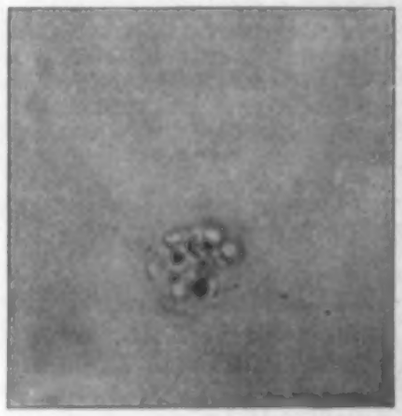
Table VII.

Balance Sheet for Alkalies Charged, Removed and Lost

	Potash, K_2O		Soda, Na_2O	
	Pounds per ton pig iron produced	Per cent total charged	Pounds per ton pig iron produced	Per cent total charged
Total charged	22.4	...	35.6	...
Lost in slag	4.5	20.0	6.3	17.0
Lost in fume, etc., from iron and cinder notches, and shell (est. 10 per cent of slag loss)	0.4	2.0	0.6	1.7
Lost in gases from top of furnace (est. 5 per cent total gas losses)	0.9	3.9	1.4	4.1
Lost by combination with brickwork of furnace, stoves, etc.	negligible		negligible	
Recovered in dust-catcher dust	0.6	2.7	1.3	3.6
Lost in primary washers (est. by difference)	12.5	55.9	24.6	69.5
Lost in secondary washers	0.5	2.2	0.2	0.6
Recovered in stove and boiler passes	0.3	1.3	0.1	0.3
Wastage from mains, stoves and boilers (est. 30 per cent of quantity recovered)	0.1	0.4	...	0.1
Lost in stack gases	2.6	11.2	1.1	3.1
Total	22.4	100.0	35.6	100.0







FIGS. 11, 12 AND 13—PHOTOMICROGRAPHS OF SAMPLE C, FINE FLUE DUST RECOVERED FROM STOVES

of pig, or 0.3 per cent of the total charged.

The amount of potash recovered, though of considerable tonnage and value, is an insignificant percentage of the total charged.

At furnace plants using burdens rich in potash where the gas is unwashed, a considerable recovery still can be effected, though some precautions must be taken to avoid the coarser, raw flue dust. Several other furnace plants in the east, acting upon our suggestion, made directly or indirectly, have been recovering potash-bearing flue dust during the last year and a half.

Dust Escaping from Stove and Boiler-house Stacks

Some idea of the relative amount of alkalies discharged per unit value of gas from blast-furnace stove and boiler stack may be gained by observing the color and depth of the fume. Dirty gas, of course, will obscure greatly the fine, white, alkaline fume. In western practice, with washed gas, the escaping stack gases show a thin, white color. At this plant the stack fume is much heavier. At the plants in the Lebanon district, using Cornwall ore, the fume is relatively very dense.

About two years ago a series of tests was made, extending over a period of about a week to determine the approximate amount of potash lost through the boiler-house stacks. The average results on the two largest stacks were as follows:

Average amount of dust per cubic foot, flue gas (62 degrees and 30 inches), grains	0.12
Average percentage water-soluble K_2O in this dust	14.70
Average percentage total	18.60

Knowing the average volume of flue gas discharged, and the average volume of fuel gas consumed by the boiler houses, and produced by the furnaces, we can calculate roughly the weight of potash lost through the boiler-house stacks per ton of pig iron.

No actual tests have been made on potash losses from the stove stacks, but they should be slightly less per unit volume of fuel gas burned on account of the greater baffling action of the stove brickwork. We will assume these losses per unit volume of fuel gas to be 90 per cent as great as from the boiler-house stacks. The soda-potash ratios will be assumed to be the same as in the average stove dust.

	Per ton pig, pounds.	Per cent of total charged.
Total potash lost in boiler-house and stove-stack gases	2.6	11.2
Water-sol. potash lost in boiler-house and stove-stack gases	2.2	....
Total soda lost in boiler-house and stove-stack gases	1.1	2.8

A considerable percentage of the primary cleaned gas at Bethlehem is further cleaned in Theisen scrubbers for gas-engine use. Practically all of the fine dirt is thus removed, the small amount passing through the fine gas main and into the combustion chambers of the engines, having practically no cutting or scouring action, even when as much as 0.03 grain per cubic foot of gas is present. Samples of this dust, recovered near the engines, were of a smooth talcy consistency. The composition is similar to the finest stove dust.

The amount of alkalies recovered in the secondary scrubbers, per unit volume of gas, is practically the same as the sum of the alkalies precipitated in the stoves (or boiler passes) and escaping through the stacks. Knowing the gas-engine consumption of fuel gas, the alkalies removed in the wash water, calculated on the same basis as for the stoves and boilers, is readily found to be as follows: Total potash lost in secondary scrubbers, 0.5 pound per ton of pig, or 2.2 per cent of the total charged; and total soda lost in secondary scrubbers, 0.2 pound per ton of pig, or 0.6 per cent of the total charged.

Balance Sheet for Alkalies

Bearing in mind the extremely difficult nature of the problem, and the necessity for including a number of estimates, Table VII is a rough balance sheet for alkalies, charged and produced in our average blast-furnace practice is given. Further, it will be remembered that this balance sheet is approximately representative of local conditions only.

Apparently there is a greater loss of soda than of potash in the primary washer. This may be due to the greater solubility of the sodium salts, or to the larger size or possibly to the difference in contour of the fume particles of sodium compounds.

Cause of "Smoky" Gas

Every blast-furnace man is familiar with the phenomenon of "smoky" or "calico" gas. This title refers to a peculiar flecked, mottled or streaked appearance of the gas flame and is concomitant with more or less imperfect combustion. In the worst cases it will not burn at all in the boiler combustion chambers, even in the presence of a good wood fire. It is more frequently noticed in boiler than in stove practice, on account of the greater surface of hot brickwork, which promotes combustion, in the latter. It is believed that no trouble in gas engines has been attributed to smoky gas. The more or less imperfect combustion of the gas is accompanied by corresponding amounts of carbon monoxide in the flue gases. The phenomenon occurs in both dirty and primary washed gas, in some plants much more frequently than in others, but at no regular intervals. This gas is not only a curiosity, but, in plants where blast-furnace gas is at a premium for steam development, its appearance is the cause of concern to the steam engineering and blast-furnace departments. The condition of smoky gas may continue for only a few minutes, or it may last for several hours. In a large plant, it can usually be traced to one, two or three furnaces, seldom being manifest in all the boiler houses, unless they are closely segregated and fed from a common gas main.

So far as is known, the cause of smoky gas has not been determined definitely and proved. Numerous samples of gas were taken when it was burning badly under the boilers, but the composition was always found to be normal. The temperature of the washed gas was not found to be above normal, indicating high moisture content, nor was there an abnormal amount of entrained water present.

Tests for "Smoky" Gas

The author is indebted to C. H. Rich, metallurgist, Alan Wood Iron & Steel Co., for the suggestion that smoky gas is concomitant with increased amounts of fume, in the gas, including cyanide or chloride. Determinations, made under his supervision, showed an enrichment of the fuel gas with one or both of these constituents when the gas was burning badly; elimination of the fume automatically restored a free-burning gas.

To test this idea further, several large samples of potassium chloride, sodium chloride and potassium cyanide were prepared, in part by grinding to about 40-mesh size, and in part to ultra 100-mesh size. A suitable aspirating spray nozzle, operated by compressed air, was inserted through the breech of a boiler gas burner. The salts were introduced easily in a thin stream through this device. In the coarser condition, none of the salts had any appreciable effect on the character of the flame. However, the ultra 100-mesh product of all three produced in a clear flame exactly the same phenomenon as observed in smoky gas. In the case of sodium chloride, which was dry and easily pulverized, the flame could almost be extinguished.

The logical reasoning from these tests is that the cause of smoky gas is a purely physical one, due to the presence of an unusual amount of exceedingly fine flume in the gas, preventing proper contact for combustion between the particles or molecules of fuel gas and oxygen.

It has been our observation that smoky gas is simultaneous with high top temperatures in the furnace, but at irregular intervals. As earlier investigators have suggested, part of the alkali salts probably circulate in the furnace many times, on account of condensa-

tion in the upper zone. But the excess accumulation must be expelled at intervals, which naturally correspond to high top temperatures, low stock lines or high hearth temperatures. The fact that cold air admixture in the hot blast, when a furnace is producing smoky gas, will alleviate the condition temporarily, constitutes additional evidence that alkali fume, in considerable quantity, is being evolved during such periods.

A considerable amount of fume also will be noticed when smoky gas is burning. It is difficult or impossible to determine the approximate average size of the ultimate fume particles in blast-furnace gas. The clammy, hygroscopic nature of the material makes microscopic work laborious. Judging from the photomicrographs made at 3,000 diameters, accompanying this paper, there are many minute particles which appear to have a diameter of about 0.01 inch in the photograph, and many others which do not exceed, say 0.04 inch. The actual diameter of such particles would therefore be 0.0000033 inch, and 0.0000133 inch diameter respectively. Assuming 0.3 grain of fume per cubic foot of fuel gas, and an intrinsic density of 2.0, the number of particles of fume per cubic foot of gas is found to reach the enormous total of over 30,000,000,000,000 and about 500,000,000,000 for the two sizes above mentioned. There would be about 32,000 to 8,000 particles per linear foot respectively, and the distance between centers of the particles would be only 0.000385 inch and 0.00124 inch respectively. These calculations are purely speculative, but they indicate the physical interference possible in the proper combustion of gas by the introduction of a quantity of fine fume particles. It will be readily understood that coarse, heavy particles of dust, such as exist in ordinary unwashed gas, per unit weight, will have much less effect in breaking up the continuity of the gas stream than fine fume.

In connection with the original suggestion of C. H. Rich, the author offers the above theory in explanation of the phenomenon of smoky gas.

The obvious method of preventing smoky gas is simply to clean the gas more thoroughly, though this is more easily said than done.

Methods for Further Recovery of Potash

In the present gas-cleaning practice at this plant it appears that there is a loss in the primary washers alone of over half of the total potash charged, or about 12 pounds per ton of pig iron produced, though, as mentioned later, this amount is probably a little high. The amount recovered, while appreciable, and representing almost clear profit, is seen to be an insignificant part of the total, less than 0.5 per cent. Potash lost in the slag, around the shell and from the top of the furnace, for all practical purposes, is lost beyond recovery. The greater part of the alkali content of the flue dust removed from the dust catchers could be recovered by leaching in water, but the percentage is too low to justify reclamation in this way. However, the potash now lost in wet washers and from stove and boiler-house stacks offers a legitimate and inviting field for its recovery. According to our balance sheet, it appears that about two-thirds of the total potash charged is now lost in the wash water and stack gases, or about 15 pounds per ton of pig iron produced.

About two years ago estimates were obtained for cost of recovery of the flue dust from several of the large boiler-house stacks, both by filtering and electrical precipitation methods; but the relatively high cost and the uncertainty in the potash market, deterred an actual installation. Later it was realized that the principal loss of potash was not from the stacks.

At intervals during the course of the last year or more, there has been in operation an experimental Cottrell electric dust precipitator, connected to the raw gas main leaving one of the dust catchers. The color of the dust recovered varied from a light to a dark gray. Several samples were analyzed and showed a potash content of about 10 per cent. The total dust leaving the dust catcher is evidently very much richer in potash than the relatively heavy particles constituting the dust in the dust catchers. However, with the above knowledge at hand, and judging from check calculations on total dust leaving the dust catchers and its theoretical potash content (by difference), it is believed that the estimated weight by difference of potash lost in the primary washers is somewhat, though not greatly, too high. For our average practice, there should be not less than 12 pounds of total, and probably about 9 pounds of water-soluble potash, now lost in washers and stacks, per ton of pig iron produced.

It may be mentioned that by weak acid treatment part of the insoluble potash content in flue dust may be rendered water-soluble, though this is not likely to be of practical application. Also, the soluble alkali salts can be recovered in tolerably pure form by leaching and evaporation.

With the foregoing figures and present potash-fertilizer value as a basis, anyone can readily determine what a very attractive proposition is the recovery of potash from blast-furnace gas at the present time. A word of caution may be appropriate. As previously indicated, the weight of potash charged per unit of iron produced is above the average at Bethlehem. There are only two or three apparently practical methods for recovery on a large scale of potash from blast-furnace gas, and they are expensive and as yet untried for blast-furnace conditions. The price of potash is certain to fall after the war.

On the other hand, the recovery of potash in connection with the thorough dry cleaning of blast-furnace gas, with certain obvious advantages as against wet cleaning, is an attractive proposition to plants now suffering from burdens rich in alkalies. In the future, dry cleaning will no doubt be adopted in many blast-furnace plants, and many thousands of tons of potash, hitherto wasted, will be reclaimed. Thus will our national resources be strengthened in this important raw material, and the blast furnace will have added another material to its increasing list of by-products.

A Real Foundation for Preparedness

(*Concluded from page 255.*)

respect to the co-operation of private manufacturers or else witness the passing of a great opportunity, through the scrapping or selling of their special equipment. This co-operation can be brought about, the board believes, and, that it should be done, is held to be both urgent and evident.

"Whatever the plan," it is added, "one thing is plainly indispensable: A continuous policy supported by continuous appropriations is essential. Sporadic orders or intermittent efforts along the lines indicated will not only be costly but fatal in times of need. Moreover, should we fail to inaugurate and pursue some plan to utilize the exceptional opportunity now offered to achieve preparedness, we probably shall never achieve it adequately and should war come upon us, we would find ourselves facing a great national emergency, self-crippled against the hour of need."

A souvenir, commemorating the 67 years of business progress the company has enjoyed, has been issued by the Dunham, Carrigan & Hayden Co., San Francisco. The souvenir is in the form of a handsome booklet called "Fierro En Paz" and is particularly unique because of its pleasing departure from the conventional type of similar publications. The text of the booklet is devoted to a description of the founding and growth of San Francisco and of the Dunham, Carrigan & Hayden Co. Many illustrations used to portray the historical events and to indicate how the company handles its stock, add to the attractiveness of the souvenir.

Recovering Benzol from Coal Gas

An Authoritative Description of Approved Methods of Making Benzol and Other By-Products in the Manufacture of Coke—New Plants Will Greatly Increase Present Production

BY F. W. SPERR, JR.

ONE of the most noteworthy achievements in American chemical industry during the past two years has been the rapid development of the recovery of benzol from coal gas. Associated principally with the manufacture of by-product coke, the business of recovering benzol in this country had previously lagged behind the parent industry which was already beginning to make striking progress three or four years before the outbreak of the war. The lag was due to a seeming lack of real demand for the material, to the abundance of petroleum and to the groundless fear that the operations necessary for the recovery of benzol would add too many complications to the manufacture of by-product coke.

Jan. 1, 1917, there were about 40 benzol-recovery plants in operation in connection with by-product coke plants having a capacity of approximately 30,000,000 tons of coal per annum. Making due allowance for the facts that a number of these plants scrub only part of their gas and that part of the benzol is immediately used for enrichment, a conservative estimate would place the present annual light-oil production at not less than 40,000,000 gallons. Three of these plants are now being enlarged, and eight new plants are in course of construction. The completion of this new work will bring the annual production of light oil up to nearly 50,000,000 gallons. The question is frequently asked: "What will become of this vast production of benzol after the war?" It must be remembered, in the first place, that the use of the benzol group of explosives, particularly trinitrotoluol and tetranitroaniline, is by no means confined to military purposes; and their consumption for commercial blasting operations will doubtless increase to a very large extent, because the war has given such a convincing demonstration of their superior qualities. The demand for military explosives is likely to continue on a considerably greater scale than before the war on account of the increased amount of military training that is being required in every country, and on account of the general recognition of the wisdom of accumulating and storing large reserve supplies of the principal explosives. It is one of the peculiar merits of trinitrotoluol that it can be stored indefinitely without risk of deterioration, and the importance of conserving this valuable asset in national defense cannot be overestimated.

The vast development of American chemical industries insures a market for large quantities of benzol products to be used for synthetic purposes. Benzene itself is an indispensable source of nitrobenzene and aniline with its long series of valuable derivatives. The manufacture of synthetic phenol, which is far outstripping that of carbolic acid made directly from coal tar, may be considered as a very important outlet for pure benzene on account of the great increase in the production of the various condensation products of phenol and formaldehyde. From toluene we obtain such well known products as benzaldehyde, saccharin and benzoic acid. Metaxylene is the source of a rather important series of dyes. The study of the other materials contained in smaller amounts in coke-oven benzol and available for the production of many interesting series of synthetic chemicals has barely begun but promises to afford striking results in the not far distant future. Passing thus briefly over the consumption of benzol in the chemical industries, it may not be out of place to consider its employment as motor fuel. So far as bulk is concerned, this bids fair to surpass any other possible source of demand. Previous to the war, Germany used over 50 per cent of its benzol production for the operation

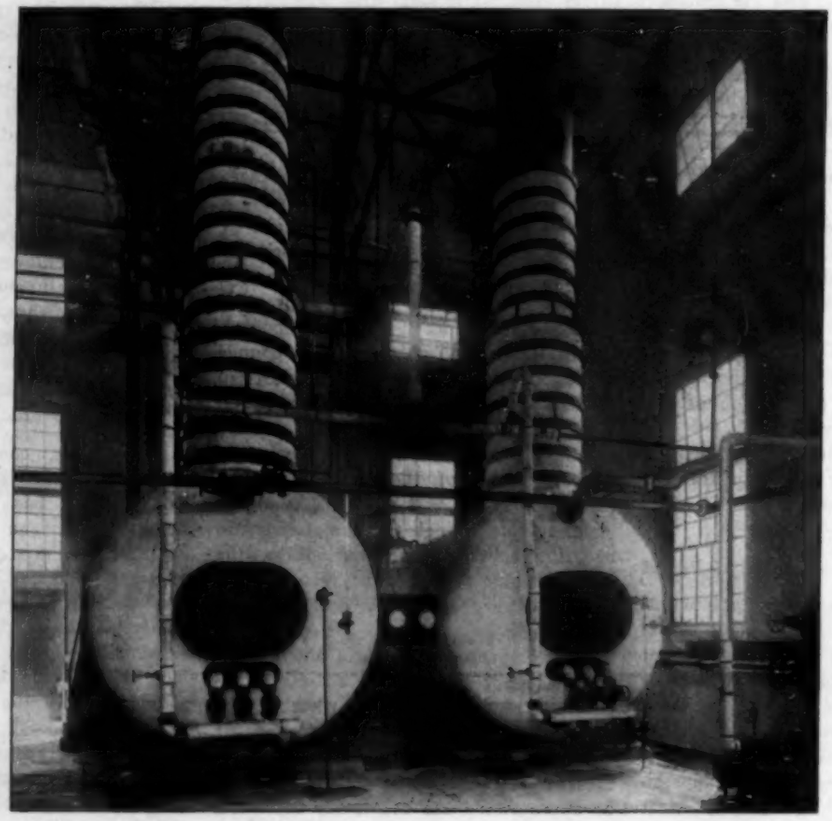


FIG. 1—BENZOL PURIFYING STILLS

From a paper read at the recent New York meeting of the American Chemical Society. The author is chief chemist, H. Koppers, Co., Pittsburgh. The article is copyrighted by the H. Koppers Co.

of internal combustion engines. The demands of the automobile industry alone are so great as to preclude the possibility of any destructive competition between benzol and gasoline. As was stated early in this paper, the benzol recovery plants now in course of construction, together with those already operating, will make an annual production of about 50,000,000 gallons of benzol. There are now over 2,000,000 automobiles in operation in this country so that the contemplated benzol production would give each machine about 25 gallons. If all the coke that the country now requires were coked in by-product ovens with benzol recovery apparatus, a total annual benzol production of about 110,000,000 gallons would be realized, or 55 gallons per machine. This total benzol production would be less than half the amount of gasoline and naphtha exported in 1915.

Coal Gas is Complex

Before proceeding with the technical description of the benzol recovery process, it may be well to give a few moments' consideration to the gas from which the materials are extracted. The gases produced by the high temperature distillation of coal are extremely complex in composition, but their constituents may be grouped in two classes, viz., easily condensable and difficultly condensable substances; the former are either solid or liquid, or are very soluble in water at ordinary temperatures; the latter, gaseous and difficult to liquefy. Most of the substances of the first group, such as water, ammonia and the heavy hydrocarbons of tar, are removed by the usual operations of condensation and treatment with fresh water or acid. The amount and nature of the easily condensable substances left in the gas after undergoing these operations depend upon the vapor tension of each. Substances of a relatively high vapor tension such as benzene and toluene remain, to a large extent, uncondensed. Only 5 per cent of the total benzol in the gas is removed with the tar in the condensing plant. Actually, of course, the gas after leaving the plant contains slight amounts of all the original condensable substances in the form of vapor, but the quantities of substances having higher boiling points than that of naphthalene are practically negligible.

Exclusive of water, the easily condensable vapors remaining in ordinary coke-oven gas, after the usual process of condensation and ammonia recovery, amount to about 1.0 per cent by volume. They might be removed by cooling the gas to a very low temperature. This was actually done on a large scale in Europe some years ago, but the method was handicapped by mechanical difficulties largely due to the separation of ice and has been altogether abandoned. The only practical alternative which can be employed to recover these vapors, without altering their chemical constitution, is to treat the gas with a medium in which the vapors are soluble, and from which they may be recovered by simple distillation.

This is the principle of every benzol recovery process in operation at the present time. It appears to have been first employed in 1859 by Vogel, who washed coal gas with fatty oils for recovering the benzol. Various processes for extracting benzol based on this principle were later patented, but it was not until 1887 that it was put into successful commercial operation. This was done in Germany by F. Brunk, who is generally acknowledged as being the founder of the modern benzol recovery industry.

Products of Light Oil

The percentages of the more important constituents of typical coke-oven light oil and the amounts usually produced per short ton of coal are as follows:

	Per cent in light oil.	Gall. per ton coal.
Benzene	66	1.782
Toluene	15	0.405
Xylene	8	0.216
Other substances, principally hydrocarbons	11	0.297
Total	100	2.700

In America the wash oil generally

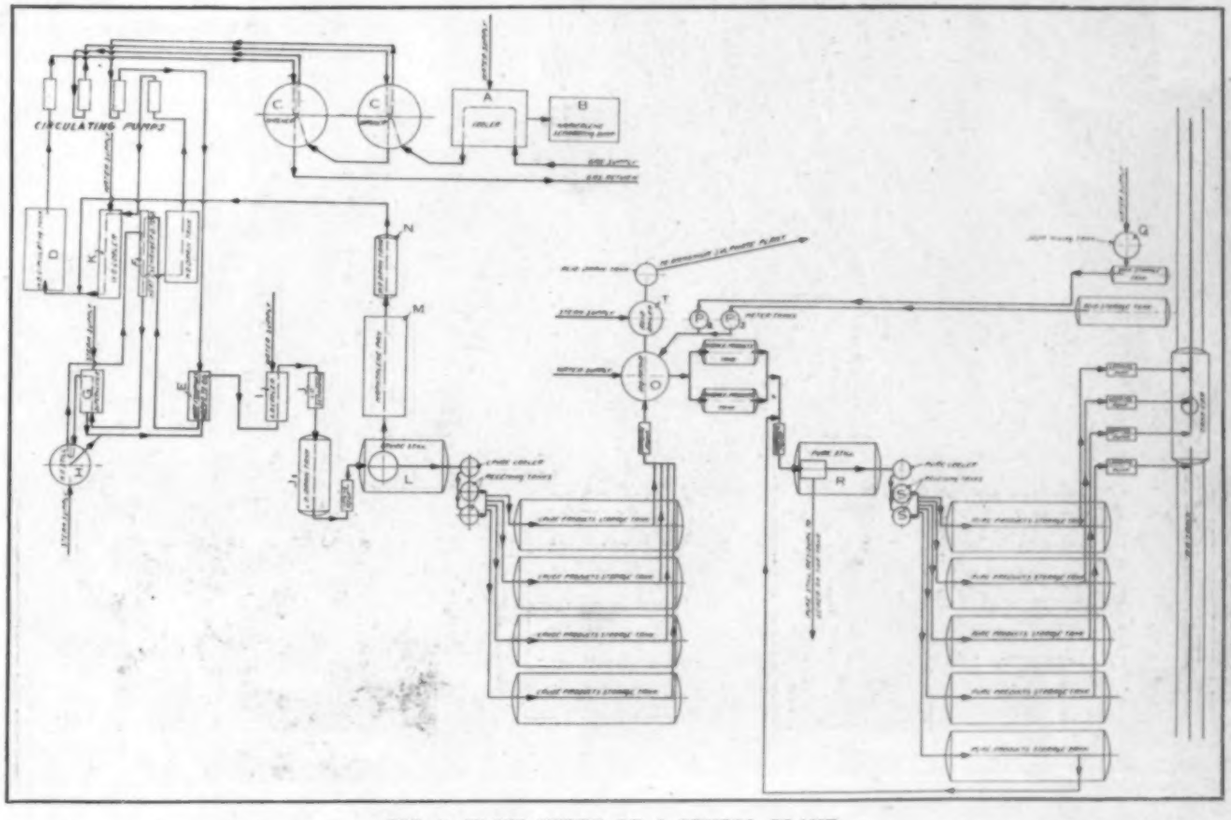


FIG. 2—FLOW SHEET OF A BENZOL PLANT

used to absorb the benzol is a petroleum product usually known as straw oil, of which at least 90 per cent should distill between 250 and 350 degrees Cent. A good absorbent oil has a specific gravity of less than 0.88 at 15 degrees Cent. and is readily fluid at 4 degrees Cent. It contains no naphthalene or pitch and exerts a good solvent action on benzol. In best practice the amount of benzol absorbed, technically the "enrichment", is kept between 2 and 3 per cent of the absorbing oil. Too high enrichment is likely to lead to loss of benzol, and too low enrichment may involve needless consumption of absorbing oil and steam.

In European practice heavy tar oils are used almost exclusively as absorbing media, and such materials may find increasing application in America. Such tar oils should contain less than 7 per cent naphthalene and 90 per cent of the material should distill between 200 and 300 degrees Cent.

Fig. 2 shows a flow sheet of a benzol plant now in operation. Previous to treatment with the absorbing oil, the gas should be cooled to a suitable temperature which may vary from plant to plant, depending principally upon such factors as its moisture and naphehalene contents, the temperature of the wash oil, and the enrichment desired. This cooling is accompanied by a direct-contact cooler, *A*. The water not only acts as a cooling medium, but mechanically washes a large portion of the naphthalene out of the gas and carries it into the separating sump, *B*. The cool gas then passes into the benzol washers, *C*, also illustrated in Fig. 2. These are tall scrubbing towers of the hurdle type, Fig. 3, effecting a very intimate and prolonged contact between gas and oil. The debenzolized gas passes out of the last washer through the return main to its point of consumption.

The fresh washed oil is pumped from the circulating tank, *D*, over the scrubbers in an opposite direction to the flow of the gas, maintaining the counter-current principle that should be adopted in nearly all scrubbing operations and bringing the fresh washing medium into the scrubbing system at a point where the gas contains the least light oil vapors. The distribution of the wash oil over the tops of the scrubbers is a very important matter, and should be done as uniformly as possible. The enriched wash oil accumulates in tanks usually located underneath the scrubbers and is pumped from these to the benzol recovery plant to be heated for the purpose of releasing its benzol constituents. Part of this heating is accomplished in the Koppers system by the utilization of the heat in the hot debenzolized wash oil leaving the still. Two heat economizers are used in this system. The cold oil first enters the heat exchanger, *E*, where it is heated by benzol vapors and steam from the still, *H*, thence it is conducted to a second heat exchanger, *F*, where it receives additional heating by means of hot debenzolized wash oil leaving the still, *H*. It is then still further heated to the maximum temperature desired

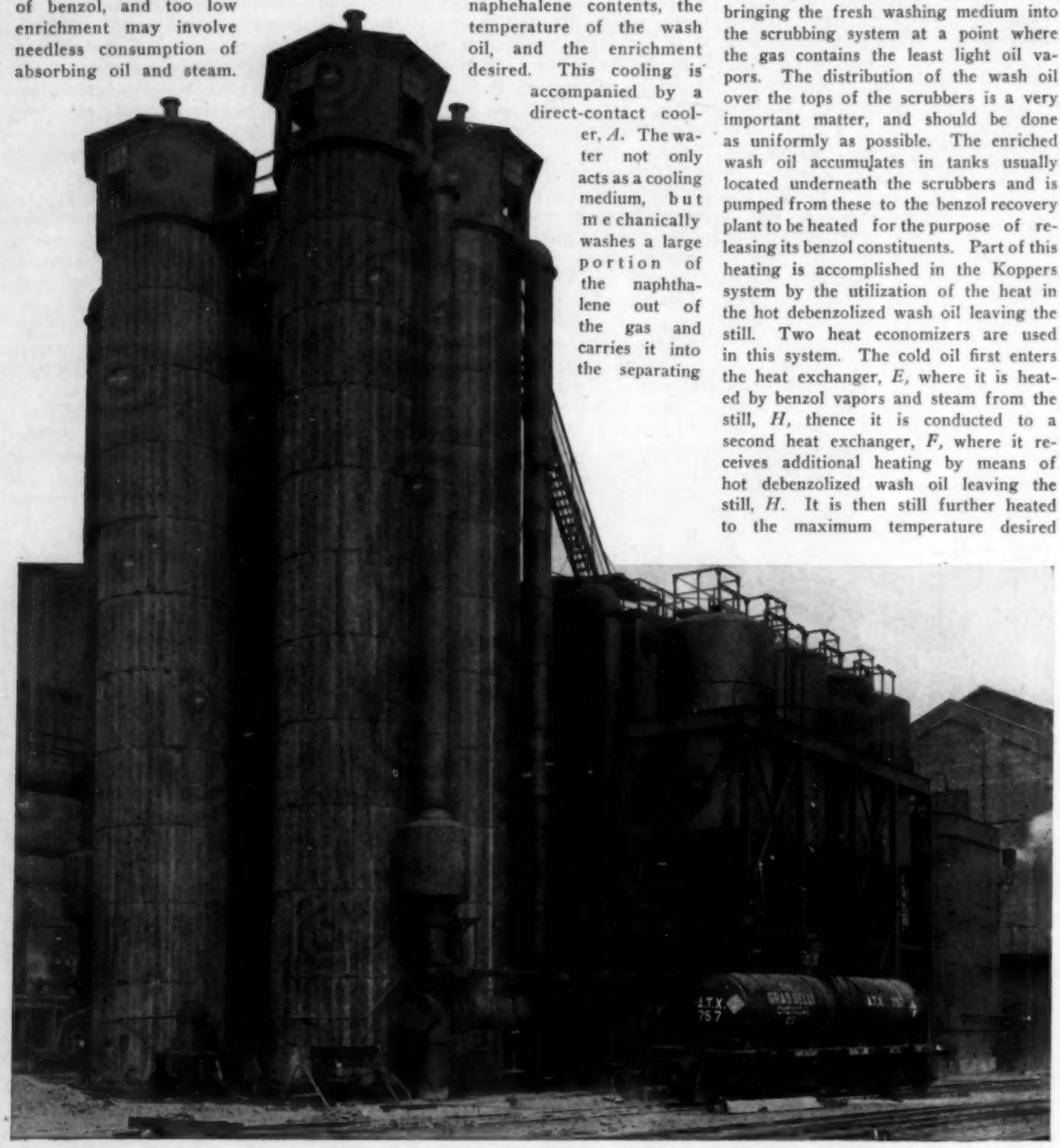


FIG. 3—SCRUBBING TOWERS OF THE HURDLE TYPE FOR BENZOL WASHING

by means of live steam in a superheater, *G*, from which it passes into still, *H*. This still is composed of a series of superimposed sections or chambers as in common distillation practice. The heated oil flows down through these sections while steam is blown directly into the lowest section and travels in the direction opposite to that of the oil. The mixture of benzol and water vapor is partially rectified in the upper portion of the still, and then enters the heat exchanger, *E*, as mentioned before, where it is condensed and the partial preheating of the enriched wash oil is effected. The remaining vapors are completely condensed, and the total condensate is cooled in a water-cooled condenser, *I*, underneath the still. The light oil is separated from the water in the condensate by means of the separator, *J*.

The debenzolized wash oil after leaving the still passes through the heat exchanger, *F*, where it gives up a part of its heat to the enriched wash oil, as stated above. Then it is finally cooled in the water cooler, *K*. The cool oil is then delivered to circulating tank, *D*, thus completing the cycle.

The light oil is accumulated in a drain tank, *J*, and portions are taken for distillation in still, *L*. This still is usually known as the crude still, the first distillation of the wash oil being made for the purpose of effecting an approximate separation of several fractions of different boiling points preliminary to washing and final rectification. This and subsequent distillations are made intermittently in stills of large capacity, 6,000 to 12,000 gallons, which give better fractionations than are possible in smaller apparatus. The continuous type of stills has not been found satisfactory in this work. The crude still does not require the elaborate dephlegmator that is necessary on the final rectifying stills. The heating is accomplished by means of internal steam coils and a direct steam spray. The benzol and toluol are principally distilled off by indirect heat, using the steam coils, and the higher boiling constituents, xylol, solvent naphtha, etc., are then distilled over by introducing steam directly into the still.

After the benzol, toluol, xylol and solvent naphtha have distilled off, a certain amount of wash oil containing naphthalene remains in the still tank. The presence of wash oil in the light oil is due not only to mechanical tapping of the heavy oil during the distillation, but also to the actual distillation of some of its constituents by the agency of the direct steam used. The products recovered from a unit of light oil vary according to the kind of coal coked, the regulation of the ovens, and the method of operation of the light oil plant.

The wash oil remaining in the still is drained into cooling pan, *M*, where it is cooled in the air to crystallize out the naphthalene. The wash oil is drained away from the latter into tank, *N*, and then is returned to the main circulating tank, *D*. In large plants where the amount of naphthalene is great, a centrifugal dryer is employed for the purpose of separating the small amount of oil remaining in the naphthalene, and also for reclaiming the naphthalene from the separating sump at the foot of the gas cooler. The crude naphthalene so obtained can be sold as such or may be put into the tar in the coke plant.

The products obtained from the crude still will satisfy many commercial purposes in normal times. However, at present the demands of chemical manufacturers for benzol and toluol of a high degree of purity have made it advisable to accomplish the complete process of purification at the coke plant to serve this important part of the trade. For this purification the crude benzols are first washed with sulphuric acid and then with caustic soda and water. This operation is accomplished in agitator, *O*, which is a large lead lined vessel with an efficient mechanical mixing device for bringing the acid and benzol into intimate contact. The acid is commercial, concentrated sulphuric acid, 66 degrees Baume. The quantity used is accurately measured from the meter tank, p_1. The caustic soda solution is prepared in the tank, *Q*, and measured in the meter tank, p_2.

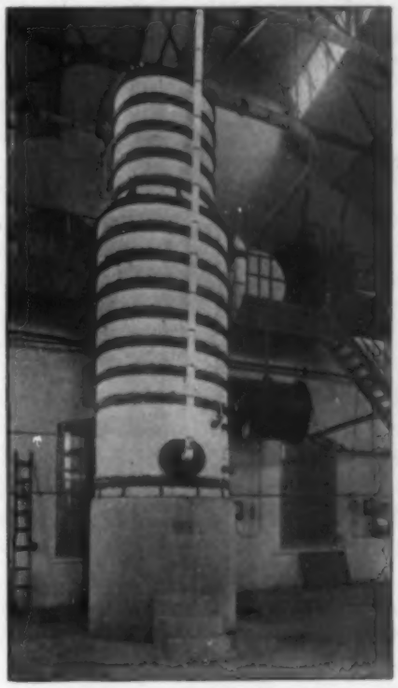


FIG. 4—WASH OIL STILL

The acid has the effect of reacting with and to a large extent polymerizing most of the impurities which consist of various olefines and substances of similar character, together with certain phenoloid bodies. This results in the formation of resinous substances of very high boiling points, part of which are insoluble in the benzols and settle out with the acid in the bottom of the agitator, while part go into solution, giving the benzol a dark brown or a reddish color. The acid sludge resulting from this operation is then drawn off. The caustic soda neutralizes any traces of acid which may remain in the agitator and effect the removal of some of the phenoloid bodies. After the soda wash, the benzol has a lighter brown color but always requires distillation. The washed benzol is delivered from the agitator to the still, *R*, also shown in Fig. 1. This still is generally of the same capacity as the crude still, but is provided with very efficient dephlegmators. Sometimes purified products of less exact boiling points are desired. In this case the washed benzols are distilled rapidly, simply to separate the benzol from the resinous materials in solution. The benzols so produced are termed "purified", e. g., 90 per cent purified benzol, 50 per cent pure benzol, etc., the nomenclature being based on the percentage in test distilling under 100 degrees Cent. The distillation for the preparation of pure products is conducted more slowly, the condensate being collected in receivers, *S*, and tested carefully before placing in the final storage tanks.

The upkeep of a benzol plant costs remarkably little, and the labor required in operation is small. A complete plant handling 5,000 gallons of light oil per 24 hours is operated by five men on day turn and three men on night turn, with two chemists for control testing and three laborers on day turn only for loading shipments and for general utility purposes.

The superheaters are subjected to the most severe usage in a benzol plant. Spare superheaters should always be provided and the apparatus arranged so as to be readily interchangeable. All apparatus for heating and cooling the wash oil should be so arranged that each individual unit can be taken out easily without disturbing the other apparatus.

At the close of the European war, when prices again become normal, it will be possible, with the large plant capacity then available, to make a substantial profit from the production and sale of automobile benzol at prices competing with those of gasoline. There are other large uses creating a demand for the various benzols and further uses will be developed as the supply becomes greater.

Daniels' War on American Plants

Involves Secret Negotiations With Englishmen

Shameful Story of How the Hadfield's Bid Was Obtained—Foreign Concern Will Not Be Able to Carry Out the Contract as Planned by the Unamerican Secretary of the Navy

IN HIS eager desire to exhibit his contempt for American manufacturers, combined with his anxiety to pander to foreign interests at the sacrifice of American interests, Secretary of the Navy Josephus Daniels overstepped the mark last week when he officially announced that the navy department had awarded contracts for 4,500 14-inch and 3,000 16-inch armor piercing shells to Hadfield's Ltd., Sheffield, Eng. Incidentally, the announcement proved he was not informed as to conditions surrounding the Hadfield bids.

Accompanying the Hadfield bids was a stipulation that that concern would not take a contract from the navy department, involving more than $1,600,000. The figure asked for the 14-inch projectiles was $356 each, f. o. b. works, Sheffield, Eng., so that the total amount represented in this proposal is $1,602,000, or $2,000 in excess of the limit set. On the 16-inch projectiles, the bid was $513 each, f. o. b. works, so that in this proposal a total of $1,539,000 is involved. It is plain, then, that Hadfield's unless the restriction referred to is removed, cannot take both contracts, which Secretary Daniels said had been awarded to the English concern. It might take all, or virtually all, of the 4,500 14-inch shells, or all of the 3,000 16-inch shells, or proportions of both. But so long as the $1,600,000 limit remains, it cannot be awarded contracts for the total of 7,500 projectiles, as Mr. Daniels' announcement said had been done. With this limit applied, the secretary of the navy would be forced to undergo the painful experience of turning part of these projectiles over to American makers. He will, of course, have to give contracts for both class of projectiles to American manufacturers, because the number asked for was 7,200 in the case of the 16-inch armor piercing shells and 8,100 in the case of 14-inch armor piercing projectiles. This is one phase of the unamerican policy of the present secretary of the navy regarding shell contracts. It does not by any means include all of the blame that rests with Mr. Daniels in the situation.

Plays a Shell Game

PERMITTED to resort to a more or less obvious pun, one can show conclusively that Mr. Daniels in asking for bids played a shell game. As might be surmised, the American manufacturer was the victim. By his own statement, made after announcing the "awards" to Hadfield's, Secretary Daniels said that not only had he asked that the English concern be invited to submit bids for the projectiles, but also that the high bids by the American manufacturers were a result of the fact that he had kept secret the department's decision to permit foreign makers to bid. He took great pride in letting it be known that he had adopted a sub rosa plan in these days of vaunted pitiless publicity in an effort to fool the American bidders. It reveals an example of duplicity in high government official circles that is amazing. To one who is acquainted with the hostile feeling Mr. Daniels entertains toward American manufacturers at the peril of American preparedness, it must be admitted it causes no real surprise, although it necessarily gives occasion for growing alarm. These secret negotiations between the unamerican secretary of the American navy and a foreign manufacturer show unmistakably that Mr. Daniels was desirous of giving as much business as possible to the latter and to deprive the American manufacturer of as much business as possible. Mr. Daniels made the entirely gratuitous statement that, had American makers known Hadfield's was going to bid, the American bids would have been lower than they were. This statement has been refuted absolutely by American manufacturers. But, assuming that Mr. Daniels stated the situation correctly, what is the logical conclusion? It is apparent, is it not, that he did not want the American manufacturers to get the business; otherwise, accepting his theory, he would have let the latter know that Hadfield's was going to bid so that the American figures would have been reduced. His theory convicts Mr. Daniels of having wantonly sought low bids from a foreign manufacturer through secret negotiations and hoping at the same time that the American bids would be higher in order that an excuse could be offered for giving the business to the foreign concern. Moreover, Mr. Daniels must have forgotten other statements he had made or he would not have implied that American manufacturers would have met the Hadfield bids had the former known the foreign figures were going to be submitted, Mr. Daniels held a conference with American manufacturers shortly after the bids were opened in an effort, pretended or otherwise, to get them to reduce their figures. He subsequently announced that they had offered to reduce the bids slightly, but not to a satisfactory basis. His own statement, therefore, disposes of the inference he gave that the American manufacturers would have even attempted to meet the Hadfield dumping figures, had they known in advance that there was to be a

foreign competitor. This is another chapter of this unsavory story of amazing unamericanism displayed when a crisis may be at hand and Americanism put to the test.

Awards Not Made

TO TURN to another phase of this ugly tale: The fact is no awards have been made to Hadfield's. The secretary of the navy has offered the foreign concern some business. That is true, although it cannot take as much as Mr. Daniels would like to have it take. The awards have not been accepted, however, and cannot be until the proper papers have been sent to Sheffield, Eng., so that they can be signed by responsible officers of the English company. And the English company cannot sign any contracts, or at least cannot fill contracts, unless the British government says so. Despite contrary statements from the secretary of the navy, it is not known that such permission will be granted. It is certain it will not be if Great Britain would find it injurious in the slightest degree to her preparedness to carry on the war. The British government is too practical and too sensible for that. It might prevent Mr. Daniels being duped in spite of himself, and actually force him to be practical, to be compelled to display Americanism, by finding himself faced with the painful necessity of giving all of the contracts to American manufacturers. The declination of the English concern of a contract within the $1,600,000 would apparently call for the forfeiture by it of its bond. This is only an incident. A nation at war is not accustomed to considering these infinitesimal items, although one wonders if Secretary Daniels would not consider the financial cost if America were at war. And, if for some reason the English concern declined to pay on the bond, the question occurs as to whether Mr. Daniels would risk international complications in order to recover the bond.

Assuming, however, that a contract within the $1,600,000 limit is accepted following the safe trip of the papers across the ocean, the next factor is the production of test shells. They would have to be sent after by means of a naval collier, despite the great expense that would involve, and the inconvenience that it would entail in these days when all the craft in the navy are being pressed into service. Then, if the tests proved successful—and no one can say whether they would or not—another trip or so would be called for in order to deliver the shells produced on contract, whose specifications may or may not be in accord with test shells that had proven satisfactory. The sending of craft after the shells involves both time and expense and would therefore make less radiant the showing Mr. Daniels tries to place on the Hadfield bids as to the time of delivery required and prices asked.

One can only speculate as to whether the shells could be transported safely across the ocean from England. In view of past submarine activities and the indications that they may again become both intensified and "ruthless", the ill portents can be imagined easily. The danger of international complications, however, it would seem, sinks into insignificance in Mr. Daniels' mind when he has to contemplate the idea of giving business to American manufacturers.

A Patriotic Resolution

THE announcement of Secretary Daniels that he had awarded shell contracts to a foreign bidder brought forth at least one legitimate scream from the American eagle within the ranks of an extraordinarily complacent congress. On last Thursday, the day following Mr. Daniels' announcement, Representative Rodenburg, Republican, of Illinois, introduced a resolution which was a stinging answer to Mr. Daniels' action. The resolution would make it unlawful for the head of any department of the government of the United States to invite and accept bids from foreign manufacturers on contracts for supplies for the use of the United States government whenever such supplies can be manufactured and furnished to the government by American manufacturers.

In one of the "whereases", the resolution made specific reference to the fact that the secretary of the navy on Jan. 17 awarded a contract for armor piercing projectiles for the use of the navy of the United States to a manufacturing concern located at Sheffield, Eng. It also referred to a contract let in 1914 by former Secretary of War Garrison to an English concern for insignia on caps of soldiers in the United States army. The resolution could have gone back much further, or at least to the Taft administration, when a contract was awarded for a German crane for the Panama canal, the crane which broke down while being tested.

But, referring to the projectile contract, the Rodenburg resolution says it is an admitted fact that the rate of wages paid to employes in the manufacturing industries of the United States is from two to four times as high as is the rate of wages paid to the employes in the manufacturing industries of England and other European countries. The resolution points out further that not less than 75 per cent of the price of any manufactured article represents the cost of labor required to produce the article. It adds that the great disparity in the rate of wages paid to United States and foreign workmen, together with the fact that all articles for the use of the government of the United States, are admitted free of duty, makes it absolutely impossible for American manufacturers to compete successfully with foreign manufacturers in supplying the government without destroying the present American wage scale. The final "whereas" says every consideration of patriotism requires that supplies for the army and navy of the United States and other departments of the federal government should be manufactured in the United States by American workmen, receiving American wage rates.

After some parliamentary bickering, the Rodenburg resolution was referred to the committee on judiciary, so that the committee might consider the "legality" of its proposals. In other words, there seemed to be a doubt in minds of those opposed to the resolution as to whether congress had the right to repeal existing law and make government department heads purchase necessary supplies in their own country. It is hard to escape the belief that this doubt was only simulated, and that the resolution was railroaded to the committee on the judiciary so that it could lie there undisturbed in a pigeonhole. It might be the object of considerable discussion on the floor of congress, but its passage by this congress does not appear at all probable.

What Can the Government Do?

IN HIS own peculiarly smug, self-sufficient way, Mr. Daniels has said he did not expect that the proposed government-owned projectile plant would have any difficulty in meeting the department's rigid specifications for armor piercing shells. His statement was in connection with comment on an advertisement published last week by the Bethlehem Steel Co., saying it had so far spent $522,881 on its 14-inch shell contract without a single shell being delivered and without the manufacturer receiving a single dollar in payment. No one will deny that there are naval officers in the department who have given close study to processes involved in the manufacture of projectiles, but it possibly would be at least more discreet of Mr. Daniels to wait until the government plant is built and makes good before he engages in any bombast as to what it can do. He might find less reason to ridicule the earnest attempts of the Bethlehem company to meet the specifications after the projectile plant of the government has a try at a real test. In any event, Mr. Daniels might have some regard for a company which is trying at great expense to meet the specifications, and will ultimately meet them, it is confidently believed, because of the vast aid it would mean to this country in the way of naval preparedness. Or does Mr. Daniels care about America being prepared? Mr. Daniels found apparently joy in saying that other countries "are able to meet the standards we require in our contracts." At least he thinks "other countries" are able to do so, and he seems to think more of other countries than of this country. Incidentally, there is a great American ordnance concern which has successfully produced 16-inch armor piercing projectiles for the American navy, the specifications being as rigid as those required for 14-inch shells. The statement made in *The Iron Trade Review* last week that no contracts for this type of projectiles had ever been awarded an American manufacturer was an error and it is gladly corrected.

Summed up, the whole transaction in connection with the shell situation shows that Mr. Daniels by secret negotiations was determined to give contracts to a foreign bidder; that he had no regard for the interests of American preparedness or American manufacturers, and was making way for a future display of vain and self-seeking publicity. It remains to be seen whether Mr. Daniels has accomplished all he set out to do. It remains to be seen also how much longer the American people will tolerate an unamerican secretary of the navy, who persists in most unamerican actions at crucial times.

Daniels Clamors for Many Millions

Bureau of *The Iron Trade Review*,
708 Metropolitan Bank Bldg.,
Washington, Jan. 23.

AT THE same time he was engaged in his remarkable effort to discredit American manufacturers of projectiles by offering contracts for that class of war munitions to a foreign bidder, Secretary of the Navy Josephus Daniels appeared before the house committee on naval affairs last week and attempted to place American ship builders in the light of disloyal citizens who cared for profits only. His testimony was a maze of misstatements, and, to say the least, showed how poorly informed he was on subjects with which he should be closely acquainted. Ship builders were given and accepted the opportunity to reply to Mr. Daniels and so far as actual evidence is concerned, made a splendid showing. But real facts and figures, unfortunately, do not always count much for a congressional committee, and it remains to be seen whether it will grant or ignore the recommendation of Mr. Daniels for $12,000,000 additional to equip the navy yards, so that they can build the four battle cruisers and three scout cruisers of the 1917 naval program. On the surface, it would seem that the committee might recommend by a purely partisan vote the appropriation sought by Mr. Daniels. However, there were Democratic members of the committee, who, while inclined to approve the Daniels' scheme for furthering his idea of state socialism, appeared to be afraid that the navy yards could not perform the task that Mr. Daniels would give them. They indicated they might want to strike some kind of a compromise and give contracts for the cruisers to private yards this year and then to appropriate for the enlarging of the navy yards, so that the latter could perform the work in the future. The fact that these vessels are to be of a size and character never before built in any country caused some government ownership advocates of the committee to hesitate about thrusting the tremendous responsibility of building them upon the government. There is some doubt that Mr. Daniels is sincere in his claim that the government should take over the work. The belief prevails that he is resorting to his present tactics in an effort to make the ship builders offer the department still better terms than those they have offered. They are terms which would be accepted by most any one other than Mr. Daniels as being exceptionally fair. Following an investigation of the books of the Newport News Shipbuilding & Dry Dock Co., and the William Cramp & Sons Ship & Engine Building Co., Paymaster Aulds, of the navy department, made a report which stated that if they were given contracts on the latest proposals they had offered, their profits would not exceed 10 per cent. President J. W. Powell, of the Fore River Shipbuilding Corporation, said that company would net a profit of 8.33 1/3 per cent if the department accepted its latest proposal, provided everything went well. It was pointed out, however, that

the cruisers, the most gigantic and powerful craft ever proposed, were experiments at best and no one could tell how successful builders would be in constructing them, how long it would take, or exactly what it would cost. But these arguments, previously advanced to him, had made no impression on Mr. Daniels.

Like all other representatives of business interests, the ship builders found it utterly impossible to co-operate with Mr. Daniels or to satisfy him in the way of prices. The upshot of it was that they went before the committee after Mr. Daniels, Assistant Secretary Franklin D. Roosevelt and bureau chiefs of the department had completed their testimony.

It was a matter of much comment that when members of the committee asked questions of Mr. Daniels which called for facts and figures and not mere theories, he had invariably to appeal to Mr. Roosevelt or one of the bureau chiefs for the answer.

Daniels Didn't Know

It was brought out distinctly by Mr. Roosevelt, whose testimony at times failed entirely to fit in with that of Mr. Daniels, that regardless of whether the navy yards are enlarged or not and they or private yards are awarded the battle cruisers and scout cruisers, congress will have to appropriate more money before they can be built. Mr. Daniels could not deny this fact because the problem had been worked out by national officers themselves. It offered an impressive commentary on Mr. Daniels' commendation of private ship builders because they woud not make a specific offer to build the cruisers within the limit of $16,500,000 set by congress for each. Mr. Roosevelt said that "tentative" figures prepared by the department showed the navy yards, after they are adequately equipped, could build a battle cruiser for $17,500,000. He acknowledged, however, that it "all depends on the system of accounting" that is adopted to tell what the cost is and conceded that the figure he gave did not include taxes, insurance, depreciation, interest on floating indebtedness, profits and other important items that private ship builders have to take into consideration. It was estimated that, because of the present situation as to the labor and material market, a battle cruiser could not be built at a private yard for less than $19,500,000, exclusive of armor and armament. However, Mr. Roosevelt told the committee that he had succeeded in having the Bethlehem Steel Co., the Carnegie Steel Co., and other manufacturers offer to reduce the price of material that would enter into the cruisers and that, with these reductions, one could be built for $18,500,000 each. It would be necessary, therefore, for congress to increase the appropriation on each cruiser by $2,000,000, or $8,000,000 altogether, before the contracts for these vessels can be awarded to private yards.

Mr. Daniels may try to block any such a plan, but instead urge congress to give him the $12,000,000 to enlarge the navy yards for the building of the battle cruisers and the scout cruisers. Only little testimony regarding the latter was brought out, but at present there does not seem to be any prospect that they will be built by private yards.

Mr. Daniels said that, if the $12,000,000 he has asked for is appropriated,

JOSEPHUS DANIELS
Smiles as He Opens the Door for English Competition

that sum, along with the $6,000,000 appropriated at the previous session for enlarging navy yards, would be distributed as follows:

Philadelphia yard, ways and shops for two battle cruisers, $6,000,000; New York yard, ways for one battle cruiser, and necessary additional equipment, $3,000,000; Norfolk yard, ways and additional equipment for one battle cruiser and two scout cruisers, $6,000,000; Puget Sound yard, ways and equipment for one battle cruiser and one scout cruiser, $3,000,000; Boston, Charleston, S. C., and Portsmouth, N. H., yards equipped for gunboat, destroyer or submarine construction, $1,000,000.

Mr. Daniels said the Philadelphia plant could be equipped to lay the first battle cruiser keel in 15 months, and that it would require 18 months to equip the Norfolk and Puget Sound yards. His statement that the navy yards could be equipped as quickly as the private yards could be was combatted by Mr. Powell, who said that the Fore River yard could be equipped in nine months and that no delay would be experienced in enlarging the ways because by the time the ship was ready to go on the ways, the latter would be built. Moreover, private builders showed that they would not have to build anything like as many shops, foundries, etc., as would the navy yards and it was also pointed out, and admitted by Mr. Daniels, that the private yards have the organizations required while the navy yards have not.

At the same time, private builders made it plain that they did not care to build the battle cruisers or scout cruisers, but had offered to do so merely to aid in hurrying the naval preparedness program. They pointed out that the work would mean much less profit to them than would regular commercial work, but that they had felt it their duty to reserve space for the government's requirements. "Appreciation" of their loyalty was shown by Mr. Daniels' insistence that they were trying to make unreasonable profits from the government. He has been utterly obdurate to and proposal made and perhaps a majority of the committee will take a similar position.

Bound Not to Be Satisfied

Vice President Henry S. Snyder, of the Bethlehem Steel Corporation, speaking for two of its subsidiaries, the Fore River and the Union Iron Work companies, said they were prepared to undertake the building of any part of the government's naval program upon any basis which the federal trade commission shall, after examination of the facts, determine to be fair. Virtually all of Republican members granted that a fairer proposition could not be offered. But it did not seem to appeal to Chairman Padgett and other Democratic members of the committee.

Different proposals had been offered by ship builders at the request of Secretary Daniels in an earnest effort to gratify his idea as to what were reasonable profits on the battle and scout cruisers, but the builders finally found they were simply wasting their time. Mr. Daniels was determined not to be satisfied. The last offer of the Fore River and Union Iron Works companies was to build a battle cruiser upon the basis of an agreed estimate as to the cost of labor and material, plus a percentage of a little more than 25 per cent to cover superintendence, interest on bonds and all other overhead expenses generally, plus a little less than 10 per cent for profit; these items in this pro-

posal being combined in a stated percentage of 35 per cent to cover overhead and profits. The companies proposed that if any saving could be realized on the estimated cost of labor and material, which was based on present day prices, the companies would be entitled to one-half the amount saved, and that in case the estimate was exceeded, the company would pay 25 per cent of the excess. Under this plan, as pointed out by Mr. Snyder, the companies were not assured of as much as 10 per cent profit, and stood liable to have that profit largely reduced in the event that final labor costs should exceed the estimate to any great extent. Proposals of the other companies were similar in most respects, except that the Cramp company asked for 32 per cent to represent overhead plus profit, while the Newport News company asked 30.8 per cent. The department itself concluded that 30 per cent was a fair proportion to represent overhead and profit, so that the difference between the private yards and Secretary Daniels was really insignificant, and could have been ironed out but for his obstinacy and hostility toward them.

Admiral David W. Taylor, chief of the bureau of construction and repair, and one of the ablest naval constructors in the world, said that $1,500,000 profit on each ship was not unreasonable and he estimated that the 30 per cent would provide that. President H. L. Ferguson, of the Newport News Shipbuilding & Dry Dock Co. has figured on the ridiculously low profit of $1,750,000—spread over four years—on a cruiser, but said before he would allow the trivial difference of $250,000 to stand in the way of an agreement he would toss coins with the secretary of the navy, if he were a good sport, to see who got the difference. President Henry S. Grove, of the Cramp company, said that company offered to build a cruiser for 10 per cent, but was not anxious for the business, while President S. M. Knox, of the New York Shipbuilding Co. said his company might take a cruiser, but that it was not asking to be given one.

Attempts of some members of the committee to back claims by Secretary Daniels that the private yards are devoting their attention to commercial business exclusively in disregard of the interests of the government developed an interesting fact. Mr. Powell, for instance, showed that at the present time the percentage of government work in the Fore River yard is 71 per cent. Mr. Knox said the percentage of government work in the yards of the New York Shipbuilding Co. is 72 per cent. The government work at the plant of the Union Iron Works Co. is 25 per cent of the total.

The following statement made by Mr. Snyder is representative of the attitude of all of the private ship builders:

"While in the early part of 1916 the new naval program was being formulated by the department and was under discussion by this committee the officers and directors of our corporation gave their earnest consideration to the part which they should offer to assume in carrying out the suggested program. At that time, our yards as well as all other yards in the country, were filled to capacity with commercial work. That this work was upon a very profitable basis, far more than we could ever hope to realize from naval contracts, is a statement which hardly calls for demonstration.

"We were thus confronted with the proposition that to the extent to which we should contract for government work, we should be compelled to sacrifice not only large profits, but also to respond to the efforts of our customers to develop the merchant marine.

"The foregoing considerations were serious, but vastly more serious and far reaching were the well known and persistent efforts of the navy department to concentrate all possible work in the navy yards, to secure a constant enlargement of government yards and thus effect a steady decrease of the amount of naval work available for private ship builders, no matter how well equipped private establishments might be to do the work.

"In view of the national exigency, however, and in spite of the manifest attitude of the navy department toward private ship yards, our corporation decided that as a matter of public duty we should offer to assist in the program of naval development which was to be undertaken by the government."

Private ship builders without exception said they would not undertake to enlarge their ways and to otherwise prepare their yards to build battle cruisers so long as there is any danger of the government competing with them and making them go to heavy expense which would result only in loss. The situation as to expediting the naval program, already anything but favorable, has become worse, with the full responsibility for it resting upon the shoulders of the secretary of the navy. It has been estimated by some that, if the navy yards actually are given the work of building the battle cruisers, they will not be completed before six years. The private yards had reduced their time to 46 months.

"D. C. and A. C. Automatic Skip and Bell Hoists" were discussed last Saturday at the January meeting of the Association of Iron and Steel Electrical Engineers, Fort Pitt hotel, Pittsburgh. The subject was presented by A. D. James, of the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.; Frank Smith, of the Pittsburgh office of the Otis Elevator Co.; F. J. Burd, Pittsburgh office of the Cutler-Hammer Mfg. Co., and R. H. McLain, Pittsburgh office of the General Electric Co.

Coke By-Products

Large Contracts Made by Munition Manufacturers

New York, Jan. 23.—Some unusually large contracts for leading coal tar products to be used in the manufacture of munitions were placed during the past week by entente governments. Pure benzol both for spot and early delivery was taken in heavy quantities and the aggregate of these will run into the hundreds of thousands of gallons. One very large spot sale was made. This foreign business had been pending for some weeks, but the sellers delayed closing it until the needs of the domestic buyers had been ascertained and the latter had been given ample opportunity to cover. The decline of peace prospects also had pushed these maters to the front. Domestic users of benzol also closed for some further lots. The unsold product for the remainder of the current year and especially for first half has been reduced to small proportions. Leading sellers predict every gallon remaining for 1917 will be absorbed by home needs. Prices are strong at 55 to 60 cents, per gallon, for spot and contract. Much of the benzol bought for export is to be converted into phenol and picric acid. Good buying of phenol direct, particularly for early shipment, also was done in the week, but the supply is heavily engaged and the inquiries cannot be satisfied without difficulty. One large spot inquiry for export is pending. Little forward phenol is offered. Prices remain around 50 cents per pound. Toluol also is sold up for many months and large purchases are practically out of the question. One or two makers recently have produced a larger amount than they had anticipated and have made new sales. Spot is $1.75 to $2, and contract, $1.50 to $1.75. Considerable contract buying has been done in solvent naphtha and the situation is more promising.

Sales of sulphate of ammonia are in occasional carloads as the supply before May or June is small. There is no contracting for extended delivery at this time. A fairly good export inquiry is in the market. There is no change in prices this week.

News of Employers and Employes

Why Wm. A. Field is Popular With His Associates is Explained by One of Them—Believe in Making Men as Well as Steel

WILLIAM ALEXANDER FIELD, for 13 years general superintendent of the South Works of the Illinois Steel Co., South Chicago, Ill., who recently resigned to become general manager of the United Alloy Steel Corporation, of Canton, O., is deservedly popular with his associates, one of whom sends *The Iron Trade Review* the following tribute to him:

"In the selection of Mr. Field to guide the destinies of this big independent corporation, the employes in the South Chicago plant see a realization of a recent prediction of John D. Rockefeller. In an address at Cornell University on the occasion of Founders' Day, Mr. Rockefeller said, 'in the future, the ability to deal amicably and successfully with labor, in preference to capacity as organizers or financiers, will determine the selection of chief executives of important industrial corporations.'

"William A. Field is just such a man. He is a firm believer in the personal relation in industry theory mentioned by Mr. Rockefeller, and at all times demonstrated his belief in all his dealings with the workingmen, that upon their success depended the success of the business. The result is that at South Works the workingmen and the executives are far from being enemies. They are partners, and their interests are common interests. Mr. Field for years has been putting into actual practice the open door policy—the policy that the brawn, the muscle, and the efforts of the workmen are as necessary to acquire success as are the brains and ability of the men they serve.

"Mr. Field will assume his new duties Feb. 1, at which time he will be succeeded by P. A. Newton, formerly assistant general superintendent at South Works. In the resignation of Mr. Field, it may be said that Canton's gain is South Chicago's loss. It is a loss felt keenly by the thousands who have come to look upon Mr. Field in the light of a benefactor, an arbiter of their differences, and a protector of their interests.

"Mr. Field is a true friend of the workingman. During his years of service at South Works, their problems have been his problems. Their personal welfare and success have at all times been uppermost in his mind. In South Chicago there are today hundreds of men who owe their positions of influence and executive authority to the helping hand extended to them by the leader they are about to lose. Mr. Field at all times has stood ready to co-operate, to advise, and to assist. In fact, because of his broad-minded policies, South Works has come to be known as the 'University of South Chicago'.

"About 11 years ago, a new department was created at South Works, known as the department of labor.

WM. A. FIELD

The primary duty of this department has always been to mete out justice to all and, to their fullest extent, carry out the spirit of the founder, Mr. Field. The activities have covered not only transactions in the mill, but outside as well, and the families of the employes have also come in for their share of advice, counsel and assistance.

"Some idea of the esteem in which Mr. Field is held by 'my associates', as he chose to call the workers and his assistants, may be had from the fact that he is an honorary member of the Lakeside Lodge of Steel Workers of America, a fact of which he is very proud. Another proof of the popularity of Mr. Field is the fact that before he leaves to assume his new duties, there will be held in Bessemer Park, in South Chicago, a public reception and demonstration in his honor. At this gathering, the operatives in the mill with their wives and children, as well as the business men and their families, will congregate to wish him success in his new venture.

"Mr. Field is not given to extolling his own virtues. He praises others, but not himself. His true character came to the surface recently, however, when in a farewell address to 'his boys' he said: 'We have made a lot of steel at South Works, but, best of all, we have made a lot of men. In looking back, I can only say that I am proudest of all when I think of the spirit of co-operation and competency which has prevailed. It has been the spirit of man's humanity to man—the spirit of a square deal for all.'

"William A. Field is a true type of the self-made man. He was born in Dixon Springs, Tenn., 48 years ago, and worked his own way through college, having been graduated at the Stevens Institute of Technology in 1891. In a quarter of a century, he has worked his way from the bottom to the top. It was in August, 1891, that a tall, muscular young fellow appeared in South Chicago and obtained a position as 'straw boss'. This young recruit was no other than Bill Field, as he is familiarly known. In July, 1903, he was promoted to the position of general superintendent.

"Mr. Field is a member of the University Club, the Chicago Club, the South Chicago Business Men's Association, the South Chicago Club, the Beta Theta Pi Fraternity, and is active in the Y. M. C. A. and other movements for civic betterment."

Important Topics Discussed

The need of action by the manufacturers in looking after their interests in the legislature of the state and country, the defense of the open shop and the alarming prospects of industrial conditions after the European war, with the present tariff, were the subjects of serious and protracted discussions at the convention in the interest of industrial conservation in New England in the Bancroft hotel, Worcester, Mass., Jan. 19. It was held under the auspices of Worcester branch, National Metal Trades Association and the Employers' Association of Worcester county and was attended by

about 500 persons, representing the master mechanics of the six New England states and elsewhere in the country. At the banquet, the speakers were Jerome R. George, of the Morgan Construction Co., Worcester, Mass., president of the Worcester branch, National Metal Trades Association; W. H. VanDervoort, East Moline, Ill., president of the National Metal Trades Association, and James A. Emery, Washington, a lawyer of national reputation. The convention was a big success and reflected credit on its originator, Donald Tulloch, secretary of both organizations, upon whose shoulders the bulk of the arrangements fell.

Bonuses Presented

Geo. W. Emmons, president of the Standard Gas Engine Co., Oakland, Cal., called the employes together recently and in a few brief remarks, thanked them for the friendly spirit they had displayed during the year just passed and presented them bonuses varying according to their length of service from $2.50 to $30. Some twenty odd employes received the $30.00 bonus, 28 the $25.00, and about 50 the smaller amounts. In all, nearly $2,000.00 was distributed among the 160 employes.

Employers Protest

The Employers' Association of Pittsburgh, with headquarters in the Oliver building, has entered a protest against the appointment of John J. Maloney as state foundry and factory inspector of the Pittsburgh district. Mr. Maloney, the association points out, is president of the Iron Molders' Union No. 46, members of which have been on a strike for about a year.

Cutler-Hammer Bonus

The shop employes of the Cutler-Hammer Mfg. Co., Milwaukee, have been notified by the company of a 10 per cent bonus of their yearly wages. This bonus goes to all of the 2,400 employes of the company.

Problems Discussed

The fourth annual meeting of the Harmony Club, an organization composed of officers, sales force and heads of departments of the J. M. & L. A. Osborn Co., Cleveland, was held at the club rooms, Jan. 3 to 5. Each member was given an opportunity to offer individual problems for discussion, and also to make suggestions for improving working conditions. On Thursday evening, a dinner was held at the Hollenden hotel for members and ladies. After the closing meeting, members assembled to receive their share of the bonus which is distributed each year by the Osborn company to its employes.

A Novel Plan

The Shepard Electric Crane & Hoist Co., Montour Falls, N. Y., has inaugurated a scheme to establish closer relations between its employes and between the employes and the officers. The company has made arrangements with the publishers of the local paper to devote practically half of the first page once a week to items of news about the company and its employes. This news appears under the heading "Shepard News". Technical schools for employes, various athletic teams and musical clubs are some of the methods already in operation at this plant to foster fraternalism among the employes.

Looking for Men

Col. W. S. Peirce, commandant at the United States armory, Springfield, Mass., is combing the country to get men enough to increase the force in the shops to 3,000 in order to fill the demands of the war department for rifles and swords. A night shift has been put on which will be increased to a full working force as rapidly as the mechanics can be obtained. About 2,000 will be hired immediately, a part of whom will augment the day force. The armory is the government's largest small arms plant and is crowded with requisitions for rifles, pistols and parts. It is also going to make machine guns. Col. Peirce says it is difficult to get men owing to the high wages offered by munition manufacturers. He said: "The men seemingly do not take into consideration the permanency of the position, the fact that the 8-hour day at the armory is not an experiment, but is established by law, or that they receive 30 days' vacation every year with full pay.

Pennsy's "Honor Roll"

A change in the method of determining the amount of pensions to be paid to retired employes of the Pennsylvania Railroad company, and its directly operated lines east of Pittsburgh and Erie, has been authorized by the board of directors and will become effective with the payments to be made for the month of January, 1917. It will result in increased allowances in a number of instances. A minimum of $15 per month will also be established. The purpose of the change is to protect employes who are unable, by reason of sickness or infirmity, to earn full time during the closing days of their service.

At the present time, the pension list—or "Roll of Honor"—of the Pennsylvania Lines East of Pittsburgh and Erie contains 3,673 names. Since January 1, 1900, when the department was established, 7,508 employes have been placed on the "Roll or Honor", to whom $10,439,362.89 have been paid.

Labor Notes

The J. N. Lapointe Co., New London, Conn., maker of broaching machines and tools, has increased the wages of its employes 10 per cent to take effect immediately "in order to encourage our employes to exert their best efforts in our behalf."

Industrial accidents in Pennsylvania in 1916 resulted directly or indirectly in eight deaths on each working day, according to records of the state commission of labor and industry. The total number of workers killed and injured was 251,488.

H. H. Doehler, president of the Doehler Die-Casting Co., Toledo, was presented a silver loving cup by employes of the concern at a dinner held in his honor. Announcement was made by President Doehler of the distribution of a generous bonus to all employes who have been with the company one year or more. The dinner was held in the new club rooms of the "Doehler Club" located in the Doehler plant.

Leased Iron Ore Mines

A new company headed by Edwin O. Holter, a New York attorney, has leased the iron ore mines of the Beach Glen Iron Mining Co., between Rockaway and Hibernia in northern New Jersey and plans to put these properties on a shipping basis in the near future. The Beach Glen mines last were operated about 12 years ago by the Wharton Steel Co. The ore is of bessemer quality and especially low in phosphorus. The shipping product runs about 60 per cent in iron. It has been estimated that the property contains about 5,000,000 tons and if present explorations now under way disclose the large body of ore expected, a separating plant with a capacity of 1,500 tons daily is to be erected by the new operators. The lease carries with it an option of purchase at $300,000 and this figure is materially reduced if this right is exercised within two years. The owners of the property are the Beach Glen Iron Mining Co., of which Cortland Nicoll, son of Benjamin Nicoll, of New York, is president.

The Republic Rubber Co. of Youngstown, has received a contract from the Dodge Automobile Co. for tires to equip 50,000 1917 cars. This contract aggregates over $1,000,000.

Ohio Manufacturers Pledge Support

Ready to Do Their Part in Preparing for National Defense —Urge Officials to Proceed as Rapidly as Possible

AT THE meeting of the Ohio Manufacturers' Association, held at Columbus Jan. 18 and 19, resolutions heartily endorsing what has been done toward national defense and favoring more definite action in the future were adopted. The resolutions were as follows:

That the Ohio Manufacturers' Association commend the establishment of the council on national defense, and the naval consulting board and that we urge them to proceed as rapidly as possible with the vast duties entrusted to them. We recognize the necessity of preparing in advance to mobilize and co-ordinate the entire resources of our country, that they may be made available in case of need. As manufacturers, we pledge them a cordial response to any demands they may make on us.

Resolved: That we urge upon the President and the congress the importance of strengthening the military control of the general staff of the United States army.

Resolved: That we regard the chamber of commerce of the United States of America as the logical spokesman for the business interests of the country in this behalf and we pledge to them our co-operation, and await their suggestions.

A Vigorous Report

The committee on preparedness and national defense, of which Jacob B. Perkins, president of the Hill Clutch Co., Cleveland, was chairman, submitted the following report, which was received with hearty applause:

"Your committee has accommodated the length of its report to the time at our disposal and not to the importance of the subject.

"We appreciate full well that this is the most stupendous proposition that ever was presented to the American people and if we add to preparedness and national defense what will undoubtedly go with it, namely, that the responsibility of not only stopping this war, but of preventing future wars is upon our shoulders, it is much the greatest question that was ever presented to any nation of any time.

"The great war has demonstrated that if this country should be drawn into the conflict, it would be vitally necessary to have available all our resources and that the military resoures rest on the industrial and that a well-developed plan co-ordinating the different elements of the great problem is a pre-requisite to any successful effort.

"There can be no possible question that the country need the services of the best business brains within its borders to help formulate the general plans and to take charge of many of the details.

"Lord Northcliffe in England has pleaded from the beginning for a government of business men and the delay in accomplishing it has cost England untold money and lives and has entailed sufferings that will endure for generations.

"In every country, it is the able men and not the titled men who are being sought. We should profit by their experience and not wait to have the lesson driven home by such suffering as has been theirs. With us so far, hysteria has pretty generally held the stage.

"Partisan politicians have attempted to make capital from the excited state of the public mind. The pen and the sword have each had their ardent followers and the time is opportune for the lead pencil. Let the composite American business man sit down calmly and do some careful figuring to determine what should be done and what can be done in this most stupendous situation and then decide to give it his personal attention. If we can get him to do this, we need not hamper him with rules and regulations. He will be handling his own money and will be careful of it and he will be dealing with the lives of his own boys and will be careful of them. He knows that we have half the productive machinery in the world and more than our share of the money and unlimited patriotic men for soldiers, and when these different elements are made properly available, our advice will command respect. He has partners and agencies and investments in all the European countries and those countries know him. They know that his love of his own country does not make him hate theirs. He grieves for them in their misfortunes and is ready to do all in his power to bring about the return of normal business conditions. He realizes that partisan politics have no place in a business meeting, and that this is very serious business; that common sense is more vital than grandiloquence; that complaints and captious fault finding are not what are required of him, but help, and that the need is immediate and urgent. He knows that whether we are to have voluntary or compulsory service, we need such team work in the leadership that it will inspire the men with confidence and respect, which is not the case now.

"He appreciates that nothing is settled until it is settled right; that war is Hell and that that is where it should be consigned to; he doesn't want to take pennies off of dead men's eyes, and will be glad to see this miserable business in munitions stopped for all time.

"Your committee is asked to make its suggestion as to what this convention should do to meet its responsibilities in this regard. We do not suggest that we should originate or formulate any plan in detail, but that we should lend our assistance to the organizations that have already begun real constructive work in the field.

"The council for national defense, working in connection with six members of the cabinet, the naval consulting board and the executive committee on national defense of the chamber of commerce of the United States, all working with General Wood and the general staff of the army, are at the head of a plan so far reaching that even to mention the names of the different agencies in all lines of effort that are working under their direction would take more time than is at our disposal. Great results have been accomplished and thousands are at work on the details, and as soon as it is humanly possible, if our armies should be needed for national or international service, the country will be ready. We are urged by these great bodies to co-operate with them in formulating and carrying out their program. This your committee unhesitatingly recommends to your honorable body and suggest that it be resolved."

The John's Machine & Stamping Works Co., Cleveland, has begun the manufacture of juvenile vehicles, making a specialty of its "three-in-one" wagon, coaster and sled, made entirely of metal. The officers of the company are: Ben E. Johns, president; Charles Stich, first vice president, general manager and treasurer; Jacob Pinckes, second vice president and assistant general manager; William Schuele, secretary, and M. J. Schuster, director.

Iron and Money: Fact and Comment

President Wilson's Address to Senate is Large Morsel for Wall Street to Digest—Stock Market Moves Cautiously —Steel Shares Holding Well

PRESIDENT WILSON'S dramatic speech before the United States senate, in which he laid down the broad principles of international relationship on which America will insist if given a place in the peace councils of the nations, has given Wall Street a tremendous morsel to digest. Until it can determine whether this second bold step toward peace is merely visionary, or has some definite aim, the stock market is moving uncertainly. International affairs are surcharged with many possibilities and the market's nervousness the past week is by no means lessened by this latest important development. The exploits of German raiders in the South Atlantic, and rumors of renewed merciless submarine warfare regardless of former pledges, have been disquieting influences tending to depress the general stock market, although steel shares last week, as a rule, more than held their own. Quotations on a number of iron, steel and industrial shares at the close of the New York stock exchange Jan. 20 and net charges for the preceding week follows:

	Close Jan. 20.	Net chgs.
American Can	46¾	+2¼
American Can, prfd.	109⅞	+ ⅞
Amer. Car & Fdy.	68	+3
Amer. Car & Fdy., prfd.	119½	+ ½
American Locomotive	79	+ ½
American Locomotive, prfd.	106⅞	+ ⅜
American Steel Foundries	61⅜	+1¾
Baldwin Locomotive	56¾	+1⅞
Baldwin Locomotive, prfd.	101¾	— ¼
Bethlehem Steel	435	—35
Bethlehem Steel, prfd.	130	—5
Colorado Fuel & Iron	47½	+2¼
Continental Can	88	—1¾
Crucible Steel	65	+2½
Crucible Steel, prfd.	116	+1½
General Electric	169½	+1½
Gulf States Steel	130	+4
International Harv. of N. J.	122	+2½
Int. Harv. of N. J., prfd.	121	+3
International Harv. Corp.	87	+3½
Int. Harv. Corp., prfd.	112¾	— ¼
Lackawanna Steel	86	+2½
Nat'l Enmlg. & Stmp. Co.	32	+5¼
Nat'l En. & Stmp. Co., pr.	98	+7
Pressed Steel Car	79	+3
Pressed Steel Car, prfd.	105½	+2¼
Pullman Palace Car	166½	+ ½
Republic Iron & Steel	80¼	+5
Republic Iron & Steel, prfd.	104¾	+ ¼
U. S. C. I. P. & Fdy. Co.	23	+2½
U. S. C. I. P. & F. Co., pr.	62	...
United States Steel	114¾	+3½
U. S. Steel, prfd.	121	+1
Westinghouse Electric	53½	+ ¼

Deere & Co. Reduce Debts

Manufacturers of agricultural implements are sharing with other industrial companies in the war time prosperity, judging from the annual report of Deere & Co., Moline, Ill. The earnings of this company for the fiscal year ending Oct. 31, 1916, were $4,117,993, equivalent to over 14 per cent on the capital invested, as compared with $3,248,023 in the previous year. A significant part of the statement is that showing the reduction in liabilities:

	Oct. 31, 1916.	Oct. 31, 1915.	Decrease.
Debentures, bonds and mortgages	$1,026,500	$2,264,000	$1,237,500
Notes payable	78,673	5,892,573	5,813,899
Accts. payable	1,719,649	2,428,901	709,251
Total	$2,824,823	$10,585,474	$7,760,650

President William Butterworth, in his remarks to stockholders, says:

"The increase over last year of the net profits is due to increased sales, the improvement in terms upon which goods are sold, good collections, rigid but well considered economies throughout the organization and the savings of interest due to the gradual retirement of the indebtedness of the company and its subsidiaries."

The income accounts of the past two years compare as follows:

INCOME ACCOUNT.

	1916.	
Total net earn.	$4,783,081	$3,904,957
Deduct:		
Admin. and gen. exp.	403,327	340,134
Int. charges	162,989	210,408
Depletion of timber lands, etc.	98,770	106,392
Net income	4,117,993	3,248,024
Prof. and loss surp. at beginning of year	5,964,037	5,364,008
Gross surp.	10,082,030	8,612,032
Divs. on prfd.	2,647,995	2,647,995
Surp. Oct. 31, 1916	7,434,035	5,964,037

Atlantic Steel Earns 64 Per Cent

The Atlantic Steel Co., Atlanta, Ga., in the year ended Dec. 31, earned a balance equivalent to 62.46 per cent on its $1,000,000 common stock, after full allowance for dividend requirements on the preferred stock. The company, after paying the preferred dividend, set aside $26,350 for the preferred dividend due next May, and after paying 7 per cent on the common stock, carried $537,168 to the surplus account, increasing the total surplus to $566,906. The income account compares as follows:

	1916.	1915.
Net income	$968,450	$283,573
Depreciation on plant & equipment	231,262	.....
Net earnings	$737,188	$283,573
Interest on first mtge. 6 per cent bonds	60,000	12,663
Balance	$677,188	$270,910

The condensed balance sheet as of Dec. 31 compares as follows:

ASSETS.

	1916.	1915.
Cash on hand and in banks	$135,223	$69,589
Bills receivable	34,356	29,490
Accts. receivable	203,913	164,046
Inventories	790,153	367,089
Investments	64,700	.....
Treasury bonds	156,000	.....
Ins. unearned	$25	.....
Constr. in process	110,767	8,501
Plant and equipment	2,149,687	2,312,620
Total	$3,645,327	$2,951,337

LIABILITIES.

Accts. payable	$214,321	$129,900
Prfd. div., due May, '17	26,250	.....
Com. div., due Jan., '17	25,000	.....
Bonds	1,000,000	1,000,000
Reserves:		
Interest	.....	2,822
Taxes	14,000	10,183
Doubtful accounts	2,021	6,509
Suspense	46,828	21,712
Prfd. stock	750,000	750,000
Com. stock	1,000,000	1,000,000
Surplus	566,906	29,717
Total	$3,645,327	$2,951,337

Financial Crop Ends

The Cincinnati Iron & Steel Co. is increasing its capital stock from $400,000 to $800,000.

* * *

Stockholders of the Wheeling Mold & Foundry Co., Wheeling, W. Va., will consider an increase of $500,000 in the capital stock on Jan. 25.

* * *

The Variety Iron Works, Seattle, Wash., established in 1889, one of the first foundries in that territory, has been sold by its owner, George James, to the Skinner & Eddy Corporation, which was formed recently to engage in ship building. The iron works will be a part of the Skinner & Eddy plant.

* * *

Stockholders of the Central Foundry Co., New York City, have authorized creation of $600,000 new first preferred cumulative 8 per cent stock. Funds provided from the sale will be used to pay off $525,000 notes maturing April 15 next and bank loans of about $50,000.

* * *

Frank L. Driver, president of the Driver-Harris Wire Co., Harrison, N. J., has sailed for Manchester, Eng., where his company will open a branch to be known as the Driver-Denman-Cooper Co. Heretofore finished material has been shipped to England from the Harrison plant.

* * *

Charles M. Hammond, president of the Hammond Steel & Forging Co., Syracuse, and formerly connected with the Halcomb Steel Co. and the Sanderson Steel Co., Syracuse, has sold his interest in the Hammond Steel & Forging Co. and has retired to become president of a new com-

pany, which will be located in Auburn, N. Y., and will be known as the Cayuga Tool Steel Co., Ltd. Mr. Hammond will have associated with him prominent interests in America and Sweden. It is the purpose of the new company to erect and operate rolling mills, a hammer plant, crucible furnaces, electric furnaces and an open-hearth furnace for the manufacture of high-grade steels. The company will specialize in high-grade tool and alloy steels.

* * *

The American Bell & Foundry Co., Northville, Mich., has elected the following officers: President and manager, Frank S. Harmon; vice president, Charles S. Filkins; secretary, William Phillips; treasurer, R. C. Yerkes. The foregoing and Charles Coldren, Frank S. Neale and Spencer Clark constitute the board of directors.

* * *

The Superior Steel Co., Carnegie, Pa., which was recently purchased by a Philadelphia and New York banking syndicate, has elected the following officers: President, James H. Hammond; vice president, Edward W. Harrison; secretary and treasurer, Joseph Hedges. The directors include the foregoing and H. P. Devens, R. K. Cassatt, E. C. Lynch, Benjamin Clark and F. Wilson Pritchett.

* * *

The Cram Engineering Co., Inc., Baltimore, has declared an initial dividend of 7 per cent on its preferred stock, payable to holders of record Dec. 30. The company was formed a year ago with a capital of $300,000, of which $100,000 is preferred and $200,000 common stock. The company has been active in financing, operating and managing industrial and public utility properties in this country and in Cuba.

* * *

Directors of the National Screw & Tack Co., Cleveland, have elected D. C. Griese an additional vice president. Mr. Griese is a member of the board. Directors and officers of the company were all re-elected. The company, President Alexander stated, had a record year in earnings, as was evidenced in the payment of a 16 2/3 per cent stock dividend and cash dividends amounting to 8 per cent during the year.

* * *

The Hamilton Steel Wheel Co., Ltd., recently organized subsidiary of the Dominion Steel Foundry Co., will be capitalized at $2,000,000, divided into 80,000 shares, par value $25. Of the total, $1,000,000 has been issued, $200,000 to be subscribed and paid for in cash by the Dominion Steel Foundry Co., Ltd., and $800,000 being fully paid stock issued to C. W. Sherman under agreement for services, patents, etc.

* * *

Directors of the Avery Co., Peoria, Ill., agricultural implement manufacturer, have resumed payment of the 7 per cent dividends on the common stock, payable Feb. 1, to stock of record Jan. 27. The company now is said to be doing a remarkable business; in December, 1915, it amounted to about $350,000 and in December just closed, about $2,000,000. And this, too, in spite of the high prices of iron and steel that prevailed throughout last year.

* * *

James E. Ferguson was re-elected president of the Ferguson Iron & Steel Co., Buffalo, at the annual meeting of that company held recently, Charles Kennedy was re-elected vice president; Charles W. Hyne, general manager, was chosen secretary; John W. Robinson, former president of the Third National bank, was elected treasurer. John W. Cowper, of the John W. Cowper Co., was elected a director. Reports submitted showed that the company's business was extremely satisfactory the past year.

* * *

The Sloss-Sheffield Steel & Iron Co.'s quarterly dividend of 1½ per cent, to be paid Feb. 1, is the first to be paid on the common stock since December, 1910, during which year three payments of 1¼ per cent each were made. The company has never paid more than 5 per cent in regular cash dividends a year. Earnings for the fiscal year ended Nov. 30, last, are equivalent to about 16 per cent on the common stock. The company has outstanding $4,000,000 in bonds, $6,700,000 in 7 per cent non-cumulative preferred stock and $10,000,000 in common stock.

* * *

Philadelphia bankers are offering $2,000,000 first mortgage 5 per cent serial gold bonds of the Sun Ship Building Co. at 100 and interest. The bonds are in coupon form and may be registered as to principal. They are redeemable in whole or in part at 102 and interest. The company was organized in May, 1916, to construct merchant vessels. Construction is limited to vessels of standard design. The property owned includes 60 acres of land along the Delaware river at Chester, Pa., on which are the engine building plant of the Robert Wetherill Co., Inc., and modern ship yard ways.

* * *

The Dayton Iron Co., which was incorporated here a few weeks ago by Chattanooga and Dayton, Tenn., business men, has notified the federal bankruptcy court that its proposal to submit a bid for the Dayton Coal & Iron Co. properties was withdrawn. The new company's stock subscribers were reported to have reconsidered their project on account of President Wilson's peace note and diplomatic exchanges on peace between European belligerents. This leaves creditors of the defunct Dayton Coal & Iron Co. without any prospect for purchase of the furnaces and ore lands.

Ohio Seamless Tube Co. Elects

The Ohio Seamless Tube Co., Shelby, O., at a recent meeting elected the following officers: President and general manager, A. C. Morse; vice president, R. C. Skiles; assistant general manager and superintendent, H. E. Brubaker; secretary and treasurer, James A. Brubaker; assistant secretary and treasurer, G. L. Reichert. E. W. Wiggins is chairman of the board; other directors are: Judge Edwin Mansfield, R. B. Bricker, W. W. Van Horn, Mr. Skiles, Mr. Brubaker and Mr. Morse.

Quick Work

In Relining and Repairing a Furnace of the Woodward Company

A remarkable record in relining and repairing a blast furnace in the Birmingham district has been made at the Woodward furnaces. Owing to the high price of iron and shortage of raw material during the Christmas holidays, it was decided to blow out No. 3 furnace on Dec. 15 and have it back in blast Jan. 1. This was a considerable undertaking considering the amount of work to be done.

The blast was taken off of the furnace on the morning of Dec. 15 and by night all the tuyere coolers were taken out and men were busy cleaning out the bottom. On the morning of the 16th, men were at work cutting out shell with Oxweld burners. There was 21 feet of shell to be taken out and replaced. This new work started 10 feet above the mantel and extended to 31 feet above. All of this plate work was taken out and replaced in 89 hours. The furnace shell above the mantel is 30 feet diameter at bottom, 21 feet diameter at top and 67 feet high. The part taken out and replaced was approximately 21 tons of plate work. In addition to this, there were two galleries put around the shell, also skip bridge was floored with ¼-inch plate, stairway, brackets, etc., were all made of steel, replacing the old wooden ones.

The brickmasons started on brick lining on the morning of Dec. 19 and finished on the night of Dec. 27, working two 11-hour shifts a day except Christmas day and night. Gas was turned on the night of Dec. 27 to dry the furnace and this was continued until Dec. 31.

The proper filling and charging was put in and it was lighted about midnight Dec. 31. Blast was put on several hours later and on Jan. 1 the furnace was making good iron, practically a new stack 17 days from cast to cast and one of these days a holiday.

The company showed its appreciation of the good work the men did by a handsome cash bonus.

The Colt's Patent Fire Arms Mfg. Co., Hartford, Conn., has closed a contract with the Italian government for machine guns totaling $2,000,000.

The Erie City Iron Works, Erie, Pa., has completed plans for the erection of a 1-story addition 38 x 229 feet, to its plant at Erie.

Railroads and Ship Yards Need Tools

Ship Builders on Atlantic and Pacific, Trunk Lines, and Steel Makers Want Machine Equipment for Replacements and Additions—Inquiries and Sales Show Slight Increase in Mid-West Markets

ACTIVE buying continues to characterize the machine tool market. Among the largest inquiries before the trade at present are several lists of tools for export. All of these are to be closed as soon as the market has been thoroughly canvassed for the earliest available deliveries. Among the large domestic lists now pending is one from the Newport News Ship Building & Dry Dock Co., Newport News, Va., which is expected to be closed in the near future; this involves nine cranes and a large number of machine tools of various kinds. The Seattle Construction & Dry Dock Co., Seattle, Wash., owned by the Todd Ship Yards Corporation, New York, has issued an extensive list, comprising mainly plate-shop equipment, which is to be placed without delay. Demand from the railroads continues to reflect the improvement recently noted. The Great Northern has an important list out, involving a large amount of miscellaneous railroad shop machinery. The Pennsylvania railroad for the first time in a number of months has issued a fairly large inquiry, involving approximately 10 shop tools, principally lathes. The New York Central has purchased three large punching and shearing machines from the Cleveland Punch & Shear Works Co., and in addition has distributed orders for some other tools. The Chicago, St. Paul, Minneapolis & Omaha has purchased four or five machines; the Delaware, Lackawanna & Western has bought a few tools and the Union Pacific has made some further purchases. The large list recently put out by the Chicago & Northwestern still is pending. In addition to one 80-ton traveling crane and 24 5-ton and 3-ton wall cranes awarded to the Niles-Bement-Pond Co., and six 15-ton traveling cranes to the Penn Bridge Co., the government has taken bids on six additional cranes for the Norfolk and League Island navy yards. Four of these are 10-ton and two 40-ton cranes. Further crane inquiries for these yards are expected to come out shortly. The Bethlehem Steel Co. has purchased 10 15-ton cranes for its ingot-mold foundry at South Bethlehem, Pa. The cranes for the Bethlehem plant at Steelton, Pa., have not yet been finally awarded. Among buyers of machine tools is the Phianna Motor Co., recently organized to establish an automobile manufacturing plant in Newark, N. J.

Chicago Market on Increase

INQUIRIES and sales are increasing in the Chicago machine tool market. While business is more active than for some months, and promises to continue so, it is not yet equal to the peak attained during the earlier days of the war. The Burlington and Great Northern railroads are on the verge of closing for a large part of their inquiries. Deliveries are only fair, but lathes, except a few standard sizes, may be obtained for immediate shipment. Grinders, planers, shapers, milling machines and radial drills are delayed several months. Sales now being made are largely for May, June and July deliveries. The supply of second-hand machines is becoming limited. Second-hand equipment is being purchased freely whenever available, many buyers preferring this course to a long wait for new tools.

Inquiries Feature Pittsburgh Market

HEAVY demand for standard equipment for shipment to domestic manufacturers features the machine tool trade at Pittsburgh. Virtually every industrial interest and nearly all of the railroads are buying machinery, either for replacements or for new additions and extensions. Dealers say deliveries have become more deferred since Dec. 31, last, due to the inability of machinery builders to operate plants at desired capacity on account of the retarded movement of freight. Congested traffic conditions also are affecting manufacturers of heavy rolling mill equipment. The Marshall Foundry Co., Pittsburgh, has closed for a 10-ton and a 15-ton electric traveling crane, for its ingot-mold plant at Josephine, Pa. The General Electric Co. has awarded contracts for a large foundry building at Erie, Pa. This company also plans to build a machine shop, 210 x 400 feet, at Erie, for the manufacture of rotary converters.

Many Inquiries Coming to Cleveland Dealers

THE Cleveland machine tool market appears to be settling into a steady gait and is devoid of any inquiries of a startling nature. A good volume of business has been closed each week, and while the total of the sales concluded does not equal the high mark set some weeks ago, the aggregate bids fair to make January a high month. Deliveries are a deterrent in many cases and a good deal of equipment has not been bought, owing to the slack shipping dates. The General Milling Tool Co., Cleveland, has been incorporated with $50,000 capital stock. J. P. Lamb, C. F. Shuler, L. Griffiths and C. Murman are interested. The Patterson Foundry & Machine Co., East Liverpool, O., is in the market for machine tool equipment. Mr. Cawood, secretary of the company, should be addressed. The Johnson Bronze Co., Newcastle, Pa., is in the market for power hammers. The Watson Mfg. Co., Jamestown, N. Y., is in the market for some miscellaneous equipment. The Atlas Crucible Steel Co., Dunkirk, N. Y., is in the market for a 30 x 30-inch x 10-foot belt-driven planer, one head on rail and one side to be equipped with grinding arbors which may be fastened on one side of the horizontal planer heads for surface grinding. The Ackerman Wheel Co., 542 Rockefeller building, Cleveland, manufacturer of steel spring wheels, is equipping a plant for the manufacture of its product and is in the market for a wide line of equipment. The Lakewood Engineering Co., Cleveland, is understood to be in the market for some heavy equipment. The Cleveland Frog & Crossing Co., Cleveland, is in the market for some miscellaneous shop equipment.

Improved Demand in Cincinnati

THE machine tool market is beginning to pick up following a somewhat dull period since the first of the year. Demand is better for lathes, milling machines and shapers. According to statements of

Dashing along

at 60 miles an hour through the black, stormy night—that's what the passenger train must do!

But the engineer knows that he will get in on time, for his locomotive is reliable throughout—***gears, cams, driving shafts, pistons, connecting rods,*** etc., are made of "AGATHON" Steels.

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"AGATHON" Chrome Nickel
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"AGATHON" Nickel Steels
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"AGATHON" Steels are made only for those who require ***high grade steels.*** They are for those manufacturers who are up against just what you are up against—conditions that require steel of the ***utmost strength*** without excessive weight.

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The Central Steel Company

MASSILLON, OHIO

BRANCH OFFICES:

Detroit Office: 326-27-28 Ford Bldg., F. Walter Guibert, District Representative
Cleveland Office: Hickox Bldg., The Hamill-Hickox Co., District Representative
Chicago Office: Room 1511-12 Lytton Bldg., 14 East Jackson Blvd., A. Schaeffer, District Representative
Philadelphia Office: 902 Widener Bldg., Frank Wallace, District Representative
Dockendorff & Co., 20 Broad St., New York, N. Y., General Export Agents

several dealers, machine tool prices are unchanged, but an advance has been considered for several weeks. Builders of electrical equipment are swamped with orders, and some cannot deliver certain types of motors and generators in less than four months or more. The Peters Arms Co. will need equipment for several large additions to its plant at Kings Mills, O. The American Oak Leather Co., Cincinnati, will purchase coal-handling equipment with a capacity of 250 tons. Special machinery will be needed by the Payne-Tate Refrigerator Co., Cincinnati, recently incorporated at $100,000 to manufacture refrigerators.

New Construction and Equipment

What it is **Where it is** **Who's doing it**

Among New England Factories

BOSTON.—Fire damaged the large storehouse of the William C. Norcross Co., building supplies, at 486 Albany street, causing a loss exceeding $50,000.

BOSTON.—The Fess Rotary Oil Burner Co. has been incorporated to do a manufacturing business with $525,000 capital by Albert A. Richards, president; Norman J. MacGaffin, treasurer, and Robert L. Hosmer.

BOSTON.—The Pressure Proof Piston Ring Co. has been incorporated with $225,000 capital by Lewis C. Marshall, president; Charles L. Case, Winchester, Mass., treasurer and R. C. Evarts.

BOSTON.—The McLeod Mfg. Co. has been incorporated to make iron and steel products with $50,000 capital by Alexander McLeod, Waverley, Mass., George F. James, Hull, Mass., clerk, and Joseph H. Hundley.

HOPEDALE, MASS.—Plans have been figured for a 4-story and basement, 70 x 100-foot addition to the wood shop building of the Draper corporation.

LEOMINSTER, MASS.—The Dodge Paper Box Co. will build a 2-story, 40 x 80-foot addition to its plant on Central street.

LEOMINSTER, MASS.—The buildings of the Horn & Supply Co. were damaged $20,000 by fire.

NEW BEDFORD, MASS.—The Continental Wood Screw Co. plans to begin work early in the spring on a 2-story, 40 x 260-foot manufacturing building to cost about $75,000.

PLYMOUTH, MASS.—The Bradley Rug Co. is erecting a 2-story, 60 x 120-foot addition to the south side of its plant.

QUINCY, MASS. — The Fore River Ship Building Corporation, has let a contract for a brick and steel, fireproof, 36-foot high, 58 x 114-foot galvanizing building on East Howard street, Quincy Point.

SOMERVILLE, MASS. — The American Tube Works has awarded a contract to the E. A. Abbott Co., Boston, for a brick, 1-story, 138 x 144-foot drawing mill on Somerville avenue.

SPRINGFIELD, MASS. — The Springfield Warehouse Trust has awarded a contract for a concrete, mill construction, 4-story, 27 x 86 x 172-foot warehouse at 385 Liberty street.

WORCESTER, MASS.—The Worcester Machine Works, successor to the C. M. Ohlin Co., manufacturer of machine parts, has leased another floor in the Baker building in which it is located.

WORCESTER, MASS.—The Flagg Marine Signal Co. has been incorporated with $100,000 capital by J. Walter Flagg, president and treasurer, and will manufacture the Flagg safety fog horn for all water craft. Its business location has not been determined.

BRIDGEPORT, CONN.—Directors of the Lake Torpedo Boat Co. have authorized the construction of a large machine shop, a large store house for naval supplies and various Minor buildings in addition to substantial additions to its docking facilities.

BRISTOL, CONN.—The Bryce Mfg. Co. has been incorporated to make tools and machinery of all kinds with $50,000 capital by William Bryce, John W. Bryce, George Bryce, and David N. Bryce.

FAIRFIELD, CONN. — The Hamilton & Deloss Co., recently organized with a capital stock of $300,000, to manufacture metal parts, has secured a site near here on which it plans to erect a plant to cost about $100,000.

HARTFORD, CONN.—The Seifert Special Machine Co. has been incorporated with $50,000 capital by T. E. Canfield, M. A. Thorpe and E. T. Canfield.

KILLINGLY, CONN.—The Killingly Mfg. Co. has let contract for a reinforced concrete, 1-story, 103 x 140-foot addition to its mill and a 7-story, 110 x 120-foot storehouse.

NEW BRITAIN, CONN.—Landers, Frary & Clark have let a contract for the erection of a 4-story, 30 x 178-foot plant addition.

NEW HAVEN, CONN.—The Pennsylvania Seaboard Steel Corporation has let a contract to the Belmont Iron Works, New York, for a steel, 1-story, 39 x 300-foot building on Wheeler street.

SHELTON, CONN. — The Driscoll Wire Co. has been incorporated with $30,000 capital by William F. Driscoll, Ansonia, Conn., Edward E. Gardner and Charles Marvin, Derby, Conn.

STAMFORD, CONN. — Stamford Rolling Mills Co. has let a contract for the erection of a 2-story, 72 x 200-foot addition.

STRATFORD, CONN. — The Bridgeport Steel Co. has started work on a brick, 1-story, 54 x 118-foot hammer shop.

WALLINGFORD, CONN.—The R. Wallace & Sons Mfg. Co. will build a brick and steel, 4-story, 100 x 270-foot, with a 1-story, 100-foot long ell addition at its plant to be used for making steel products.

WATERBURY, CONN.—The New Haven Dairy Co. has let contract to the Flynt Building & Construction Co., Palmer, Mass., for a brick and steel, fireproof, 3-story, 73 x 67-foot plant on Watertown avenue.

WINSTED, CONN.—The Fitzgerald Mfg. Co. will build a brick and steel, 3-story addition to its plant on Meadow street.

Along the Middle Atlantic Seaboard

NEW YORK.—The American Can Co. is taking bids on the structural contract for a 6-story plant and garage, 201 x 309-foot, to be erected at Forty-third street and Second avenue.

NEW YORK.—Lemmaier, Schwartz & Co., manufacturers of tin foil, etc., 207 East Twenty-second street, are about to erect a 6-story, 25 x 100-foot and a 42 x 100-foot plant addition.

NEW YORK.—The ammunition plant of the Canadian Car & Foundry Co. near Kingsland, N. J., was badly damaged by explosions Jan. 11. Newspaper reports set the loss at $5,000,000.

NEW YORK. — The Hooven Automatic Typewriter Co. has been incorporated with $3,000,000 capital to manufacture typewriter devices and accessories by G. C. Patten, H. H. Hazelloff, and M. E. Roberts, Manhattan Square hotel.

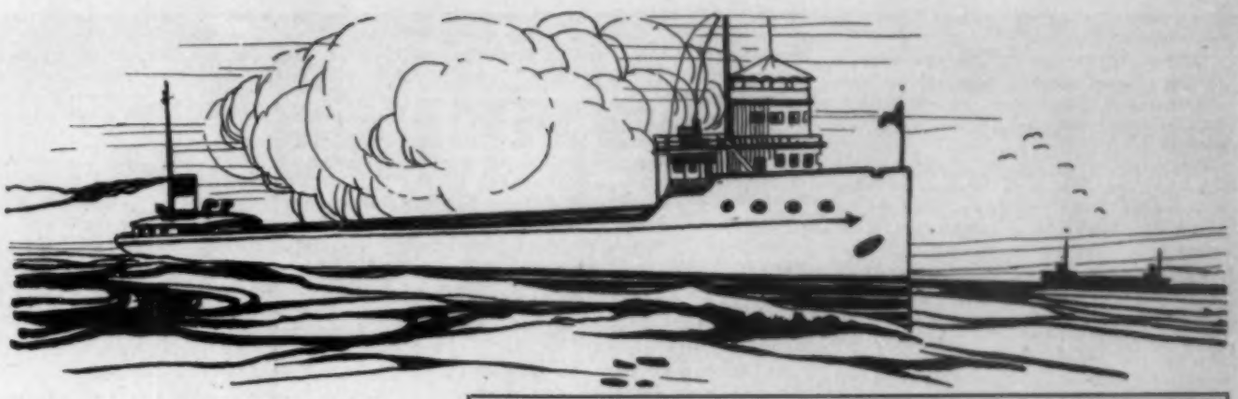
NEW YORK.—The D. & E. Storage Battery Co., 119 W. Fifty-fourth street, has been incorporated with $50,000 capital to manufacture storage batteries and generating systems by J. E. Reid, E. Kendall, B. F. Sennet, 3875 Broadway.

LINDENHURST, L. I., N. Y.—Vulcanite Mfg. Co. has let a contract for the erection of a 2-story manufacturing addition.

TOTTENVILLE, S. I., N. Y.—Harry Cossey, proprietor of a ship building and ship repair yard here, is negotiating for the purchase of additional property adjacent to his plant. His intention is to double his present capacity.

CLIFTON, N. J.—The Clifton box factory was damaged to the extent of several thousand dollars by fire recently.

JERSEY CITY, N. J.—Riegel Sack Co. has



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The Tod-Stambaugh Company

Perry-Payne Building

CLEVELAND - - OHIO

let a contract for the erection of a 132 x 136-foot addition.

JERSEY CITY, N. J.—The Goldschmidt Thermit Co. has bought a large site on Johnson avenue and Bishop street, on which it will build a 4-story plant for the manufacture of thermit.

KEYPORT, N. J.—A 150 x 300-foot plant is being erected here for the Aeromarine Plane & Motor Co. The building is to be devoted to the manufacture of aeroplanes and is expected to be operating by spring.

KEYPORT, N. J.—The dry dock and ship repair plant formerly owned by Russel Post has been acquired by the Keyport Dry Dock Co., capitalized at $100,000. The plant has been idle for several months, but will be enlarged and put into operation immediately. G. A. Williams, Warwick, N. J., W. S. Stuhr and W. Vogt, Hoboken, N. J., control the new company. Mr. Williams will move here to take charge of the plant.

NEWARK, N. J.—Hanson & Van Winkle, 269 Oliver street, will add a story to their present 3-story, 22 x 75-foot building.

NEWARK, N. J.—The Fletcher Thompson Engineering Co., Bridgeport, Conn., has completed plans for a refining plant to be erected here for the Union Smelting & Refining Co., Avenue D and Fourteenth street, New York.

PERTH AMBOY, N. J.—The Roessler & Hasslacher Chemical Co. has let contracts for the erection of a huge new chemical plant here which is to cost several hundred thousand dollars.

TRENTON, N. J.—City commission contemplates razing score of buildings on North Broad, North Warren and East Hanover streets and erecting big trolley terminal for three suburban lines. The cost will be between $600,000 and $800,000.

TRENTON, N. J.—Z. Z. Davies, Pittsburgh; A. L. Wilson, Portland, Ore., and Paul W. Custer, San Francisco, are at the head of a new company to erect a hotel in this city at a cost of between $600,000 and $800,000. The architect is John Canning, Wilmington, Del.

ALLENTOWN, PA.—International Motor Co. has started work on the erection of a 1-story, 60 x 70 and 45 x 50-foot addition.

ALLENTOWN, PA.—Works is to be started here at once on the construction of a large motor truck plant for the Bethlehem Motor Corporation, recently organized by Martin E. Kern, vice president of the Penn Counties Trust Co.

ESSINGTON.—Westinghouse Electric & Mfg. Co. is taking bids on the structural contract for five large buildings to comprise a portion of the huge new plant which it proposes to establish here in the near future. The buildings on which bids are being taken include two machine shops, a foundry, a pattern storage and an assembling shop altogether involving 7,500 tons of steel. A large number of 100, 50-ton and smaller cranes, will be required. The plant will be devoted to the manufacture of ship and ship building equipment, turbines, etc.

PHILADELPHIA.—The Hale & Kilburn Co. has let a contract to Cramp & Co., for the erection of an 8-story building at Sixth and Filbert streets, to cost about $150,000.

PHILADELPHIA.—Barrett Mfg. Co. has let a contract for the erection of three additions, 65 x 108, 65 x 121 and 65 x 69 feet, each 1-story, to its coal tar products plant.

PHILADELPHIA.—Link-Belt Co. has let a contract for the erection of a 1-story and mezzanine manufacturing building, 211 x 222-foot, to be located at Blabon street and Hunting Park avenue.

WARREN, PA.—The Allegheny Steel Tank Car Co. has been incorporated with $100,000 capital by G. L. Craft, U. G. Lyens, H. D. Kopf, A. J. Hazeltine, H. A. Logan, Joseph A. Schofield, all of Warren, and William Muir, Titusville.

SOLLERS, MD.—The Aluminum Ore Co., East St. Louis, Ill., stock of which is owned by the Aluminum Company of America, Pittsburgh, plans to erect a plant, to manufacture anhydrate of aluminum from bauxite ore, to cost about $700,000.

Activities in the Central States

BUFFALO.—The Perfection Machine Works has been incorporated with $10,000 capital by J. E. Harris and E. A. and B. J. Phillips, 314 Fourteenth street.

EASTWOOD, N. Y. — Engineer A. H. Marscher, of the Pierce, Butler & Pierce Mfg. Co., has completed plans for a $175,000 plant addition to be erected here for J. P. Duryea, Bronxville, N. J.

SCHENECTADY, N. Y. — The General Electric Co. has let a contract for the erection of a large foundry extension.

BARBERTON, O.—A foundry to cost $25,000 will be built by the Semi-Steel Foundry Co. Plans have been completed and bids will be taken soon.

CANTON, O. — The Sell Sporting Goods Co. plans to erect a 3-story, 75 x 120-foot structure to cost $25,000.

CINCINNATI.—The Oakley Machine Tool Co. has increased its capital from $60,000 to $110,000, to extend its manufacturing facilities. Definite plans have not been made public.

CINCINNATI.—The Linde Air Products Co., New York, will construct a local branch 122 x 122.8 feet at Melish and Stanton avenues, Walnut Hills. Plans have been prepared and will be made public soon.

CINCINNATI. — The Cincinnati Iron & Steel Co. has increased its capital from $400,000 to $800,000. The company has just finished the construction of a large warehouse and is at present erecting another.

CINCINNATI. — The American Radiator Co. will build a storage house 150 x 200 feet of fireproof construction, at the C. H. & D. railroad and Summer street. Preliminary plans only have been prepared.

CINCINNATI.—The Automatic Door Control Co. has been incorporated with $50,000 capital to manufacture a patent door control, by W. H. Burtner Jr., L. Alvin Kreis, Charles Broman, Jesse S. Wentworth, and Walter Schmitt.

CLEVELAND.—The Wonder Heater Mfg. Co. has been incorporated for $25,000 by F. A. Cottier Jr., J. P. Kalina et al.

CLEVELAND.—The Ohio Welding Co. has been incorporated with $10,000 capital by W. G. Radcliffe, H. E. Davis and C. H. Mueller.

CLEVELAND.—The L. N. Gross Co., 1250 Ontario street, plans to erect a new plant to cost $100,000 at Lakeside avenue and Third street.

CLEVELAND.—The Clay Workers Equipment Co. has purchased 30 acres near Bedford, O., which will be improved with new structures to be used for the manufacture of brick and tile.

CLEVELAND.—The Wood Cushion Wheel Co. has been incorporated with $500,000 capital to manufacture a new type of automobile wheel invented by E. B. Woods, one of the incorporators.

FOSTORIA, O.—The Allen Motor Car Co. announces it soon will build a large automobile and accessory plant on a 50-acre site recently purchased.

HOOVEN, O.—Plans are in progress for an addition, 60 x 300 feet, to the Cincinnati Horse Shoe Co.'s plant, at this place. Bids will be taken in about a month.

LORAIN, O.—The Lorain County Electric Co. plans to make extensive improvements to its power plant.

SPRINGFIELD, O.—The Springfield Light, Heat & Power Co. plans to spend $125,000 for plant improvements consisting of cold storage houses and boiler rooms. A substation also will be erected.

WARREN, O.—The Storage Transfer Co. plans to erect a warehouse.

WARWICK, O.—The Sterling Rubber Mfg. Co. has been incorporated with $25,000 capital W. H. Harter, L. Y. Croft and J. A. Whitticar.

LOGAN, W. VA.—A light and power plant to cost $200,000 will be built by the Logan County Light & Power Co. Plans are in progress and bids will be taken about Jan. 26.

SHENANDOAH, W. VA.—The Norfolk & Western railroad contemplates the erection of repair shops here. J. E. Crawford, Roanoke, is the engineer.

ST. ALBANS, W. VA.—The Roessler & Hasslacher Chemical Co. is about to construct a plant here to be devoted to the manufacture of coal tar products. Ralph N. Sargent of the company's Perth Amboy, N. J., works is to be works manager of the new plant.

LOUISVILLE, KY. — W. Gwilym Owen, 2161 Sherwood avenue, is planning to build a plant for producing special steel products, including an open hearth, roughing and bar mills, wire rod and hoop mills and sheet mills with tin and galvanizing departments.

PADUCAH, KY.—The Illinois Central railroad is reported to be contemplating extensive additions to its repair shops at Paducah, as well as a new bridge to cross the Ohio river at Brookport, Ill.

ALEXANDRIA, IND.—The General Insulating & Mfg. Co. will remodel for its own use the old Penn-American plate glass factory at an estimated cost of $500,000. Work will be started in the spring.

FORT WAYNE, IND.—Plans are being prepared for an addition 150 x 250 feet to the plant of the Bass Foundry & Machine Co. Facilities for the turning out of extra heavy castings are desired. Work will be started in the spring.

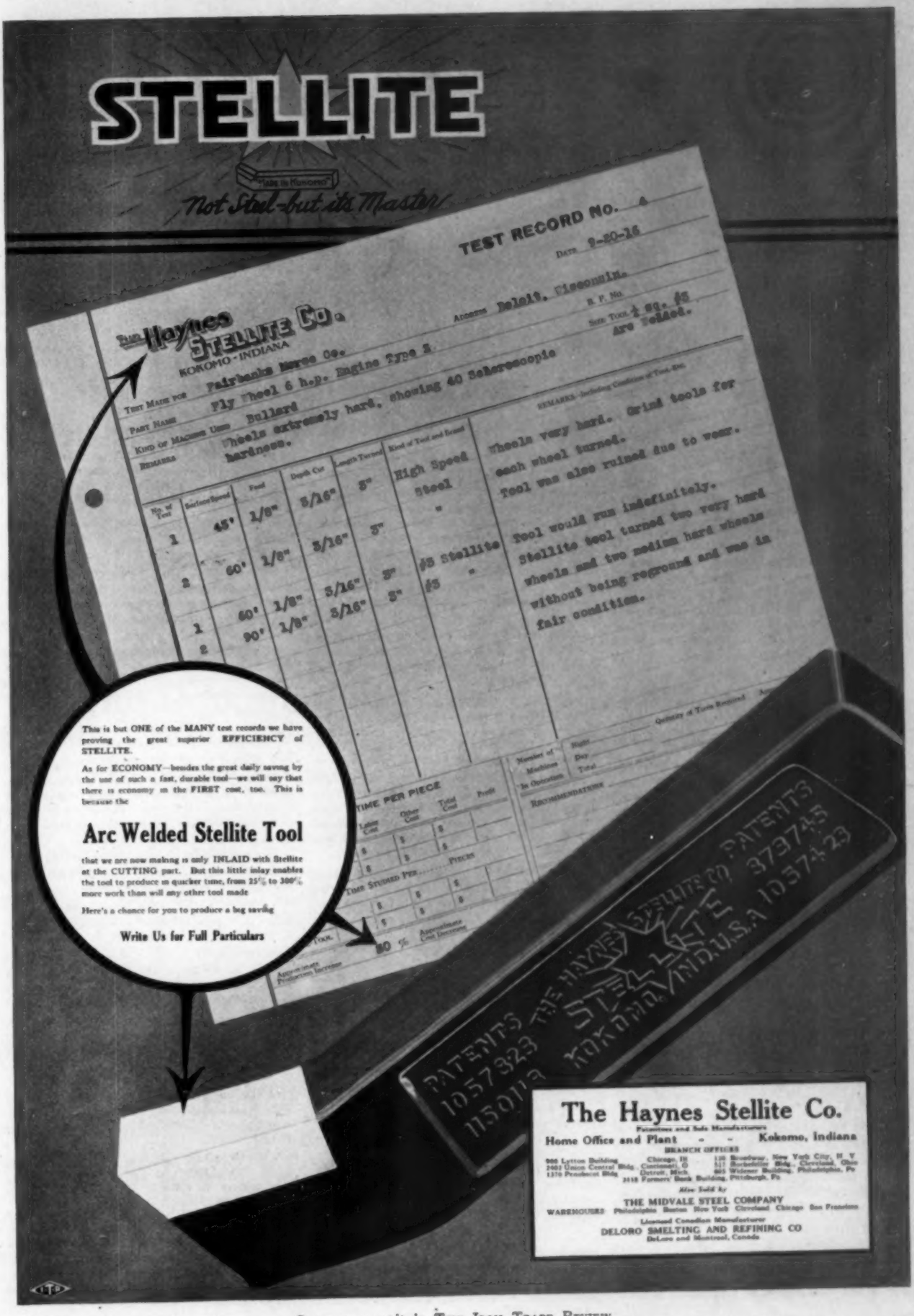
LA PORTE, IND.—The chamber of commerce soon will announce the name of a new manufacturing company which is capitalized at $100,000 and which will locate in this city.

SULLIVAN, IND.—The Sullivan Mfg. Co. has been incorporated with $10,000 capital to manufacture implements and tractors. Directors are Hix W. Davis, William C. Alsman, E. A. Billman, James M. Sinclair, and W. T. Mellott.

UNION CITY, IND.—The Haynes Automobile Co., Kokomo, Ind., plans to erect a new factory at Union City to be 167 x 1,300 feet and to be equipped with modern machinery.

WASHINGTON, IND.—Fire caused a loss of $30,000 in the car department of the B. & O. railroad shops several days ago.

BELLEVILLE, ILL.—The Belleville Malleable Iron Co. has been incorporated with


STELLITE
"Hate is Honored"
Not Steel-but its Master
TEST RECORD No. 4
DATE 9-20-16
The Haynes STELLITE Co.
KOKOMO-INDIANA
ADDRESS Beloit, Wisconsin.
TEST MADE FOR Fairbanks Morse Co.
PART NAME Fly Wheel 6 h.p. Engine Type S
KIND OF MACHINE USED Bullard
REMARKS Wheels extremely hard, showing 40 Scleroscopic hardness.
Wheels very hard. Grind tools for each wheel turned.
Tool was also ruined due to wear.
Tool would run indefinitely.
Stellite tool turned two very hard wheels and two medium hard wheels without being reground and was in fair condition.
This is but ONE of the MANY test records we have proving the great superior EFFICIENCY of STELLITE.
As for ECONOMY—besides the great daily saving by the use of such a fast, durable tool—we will say that there is economy in the FIRST cost, too. This is because the
Arc Welded Stellite Tool
that we are now making is only INLAID with Stellite at the CUTTING part. But this little inlay enables the tool to produce in quicker time, from 25% to 300% more work than will any other tool made
Here's a chance for you to produce a big saving
Write Us for Full Particulars
PATENTS 1057323 1150114
STELLITE CO. PATENTS 3737455 1057429 THE HAYNES STELLITE KOKOMO, IND. U.S.A.
The Haynes Stellite Co.
Patentees and Sole Manufacturers
Home Office and Plant - - Kokomo, Indiana
BRANCH OFFICES
900 Lytton Building, Chicago, Ill
2401 Union Central Bldg., Cincinnati, O
1370 Penobscot Bldg., Detroit, Mich.
120 Broadway, New York City, N. Y.
517 Rockefeller Bldg., Cleveland, Ohio
605 Widener Building, Philadelphia, Pa.
3118 Farmers' Bank Building, Pittsburgh, Pa.
Also Sold by
THE MIDVALE STEEL COMPANY
WAREHOUSES Philadelphia Boston New York Cleveland Chicago San Francisco
Licensed Canadian Manufacturer
DELORO SMELTING AND REFINING CO
DeLoro and Montreal, Canada

$2,500 capital by Paul Joguel, C. Herzog and George C. Logan.

CHICAGO. — H. Nelson, 569 West Van Buren street, will build a 2-story machine shop costing $25,000.

CHICAGO.—The Bell & Howell Co. will build a 1-story addition to its plant at a cost of $15,000.

CHICAGO.—The Acme Steel Goods Co., 2934 Archer avenue, will build an addition costing $15,000.

CHICAGO. — The Western Steel Car & Foundry Co. will build a 1-story addition costing $40,000.

CHICAGO.—The Shur-Loc Co. of Illinois, 208 South LaSalle street, has increased its capital from $5,000 to $100,000.

CHICAGO.—The Butler Iron Co., Rookery building, has increased its capital stock from $50,000 to $2,000,000.

CHICAGO.—The Argo Iron & Metal Co., 325 South Green street, has been incorporated with $20,000 capital by George C. Knauff, Samuel Steinberg and George Rosenberg.

CHICAGO.—The Reder Foundry Co., 2125 Canalport avenue, has bought a site at Oakley avenue and Thirty-fifth place, where it will build a foundry costing $30,000.

CHICAGO. — The Chicago Ship Building Co. will build a 2-story steel machine shop costing $12,000. F. W. Fischer, 9154 Commonwealth avenue, is architect.

CHICAGO.—The Hurley Machine Co., 29 South Clinton street, is preparing to erect a new plant, three stories, costing from $300,000 to $400,000.

CHICAGO.—The Aldon Co., manufacturer of railway supplies, will build a 1-story plant costing $10,000. R. G. Pierce, 10 South LaSalle street, is architect.

CHICAGO.—The Tip Top Bed Spring Mfg. Co. has been incorporated with $2,500 capital by Joseph Schwartzman, Samuel Siegall, Joseph Strauss and George R. Bruce; 1419 North Ridgeway avenue.

CHICAGO.—The Riverside Foundry & Machine Works has let the contract for a machine shop 42 x 132 feet to cost $12,000. Rudolph Kaufman, 106 Buffalo avenue, is president.

CHICAGO.—Bids will be asked about Jan. 1 by Holmes, Pyott & Co. on a machine shop and fabricating shop 125 x 216 feet, 30 feet high, to cost $30,000. H. H. Mahler, River Forest, Ill., is architect.

ELLSWORTH.—Pierce county is making plans for the Trenton bridge over the Wisconsin channel of the Mississippi river containing five 120-foot steel truss spans. M. W. Torkelson, Madison, is engineer.

FRIENDSHIP, WIS. — The county will build a 1,000-foot and a 650-foot I-beam bridge. John McGregor, Hancock, Wis., is highway commissioner.

GREENUP, ILL.—Cumberland county will receive bids until Jan. 20 for a reinforced concrete girder bridge of four spans. J. A. Decker, Toledo, Ill., is county superintendent of highways.

HARVEY, ILL.—The Whiting Foundry & Equipment Co. is preparing plans for a steel foundry addition. F. A. Rundle is manager.

JOLIET, ILL.—The Wrought Washer Co., manufacturer of hardware specialties, has sustained a loss of $50,000 by fire at its plant.

METROPOLIS, ILL.—The Wilson Stove Co. will build a foundry and nickel shop costing $45,000.

MILWAUKEE.—Architect Herman J. Esser, Camp building, will take until Jan. 22 for the steel sash for the first unit of the new Cutler-Hammer Mfg. Co. plant. The first building will be of reinforced concrete, five stories and basement, 120 x 250 feet.

MILWAUKEE.—A 4-story fireproof addition, 100 x 410 feet, will be erected by the Hummel & Downing Co., paper and fibre, on North Cambridge avenue. Plans are in charge of O. C. Uehling, architect and engineer, 605 First National Bank building. It will be of beam and girder construction, with brick curtain walls, and the equipment will include, besides special paper mill machinery, three elevators, conveyor system, new water tanks, sprinkler system, fire escapes, steel rolling doors, etc. The mechanical engineering work is in charge of James Carey, M. E., Chicago.

PEORIA, ILL.—The Pittsburgh Oil Refining Co. of Pittsburgh, is planning to install a storage tank and build a foundry and supply house at Peoria, at an expenditure of $200,000.

SAUK CITY, WIS.—The Farmers' Packing Co., 154 West Randolph street, Chicago, is having plans prepared by Architects Schneider & Hellstrom for a $75,000 packing plant to be erected at Sauk City. The main building will be 60 x 120 feet and the power house, 30 x 34 feet.

STERLING, ILL.—The Sterling Foundry Co. plans an addition 50 x 50 feet.

STOUGHTON, WIS.—A $25,000 addition will be erected by the Wisconsin Dairy Products Co. to its milk condensery at Stoughton. Three new 150 horsepower boilers will be installed. H. M. Clark is general manager.

WEST ALLIS, WIS.—The Davis Mfg. Co., F. W. Davis, president, Fifty-seventh and Mitchell streets, is planning to build a foundry addition in the spring.

ANN ARBOR, MICH.—Bids will be taken about Feb. 1 for a reinforced concrete bridge 620 feet long to cost $45,000. John J. Cox, Ann Arbor, is engineer.

ANN ARBOR, MICH.—The Detroit Edison Co., Washington and State streets, Detroit, will receive bids soon on a hydro-electric plant on the Huron river to cost $140,000. G. S. Williams is engineer.

BAY CITY, MICH.—Burns & McDonnell, Kansas City, Mo., have made plans for a waterworks system to cost $850,000, including four low service pumps, four 200-horsepower tubular boilers and high service pumps with a capacity of 10,000,000 gallons per day.

DETROIT.—The J. Mack Printing House will build an addition 7 stories 80 x 100 feet to cost $100,000. Albert Kahn is architect.

DETROIT.—The Detroit Valve & Fitting Co., E. B. Whitcomb, president, will build a foundry addition costing $40,000.

DETROIT.—The Spranger Rim & Wheel Co. will build a manufacturing plant containing several 1-story units. N. M. Spranger, 139 Beaubein street, is president.

DETROIT.—The Michigan Gear & Engineering Co. has been incorporated with $50,000 capital to manufacture gears and machinery by R. and J. Wilde, N. B. Peterson, et al.

DETROIT.—The Sanitary Steam Flat Iron Co. has been incorporated with $100,000 capital by F. H. Wheeler, P. E. Muraine and O. E. Day.

DETROIT.—The Edmonds & Fulton Co. has been incorporated with $25,000 capital to manufacture screw machine products by J. D. Edmonds, R. S. Fulton and L. F. Johnson.

DETROIT.—The American Trap Co. has been incorporated with $10,000 to manufacture plumbing and heating supplies and to operate a general foundry by J. L. Wells, B. C. McClellan and R. J. Fenton. The business of the company will be carried on in Toledo, O.

MUKEGON, MICH.—The Lakey Foundry Co. will build a foundry 200 x 310 feet.

ST. JOSEPH, MICH.—The St. Joseph Iron Works, 606 Water street, is asking bids on a pattern shop and storage building 25 x 100 feet to cost $8,000.

ALBERT LEA, MINN.—The Sprite Tractor Co., H. J. Bierman, secretary, 309 South Third street, Minneapolis, will build a factory, 75 x 100 feet, costing $30,000.

MINNEAPOLIS.—The Minneapolis General Electric Co. plans to erect plant 20 x 375 feet at Sixteenth and Chestnut streets, costing $500,000.

ST. PAUL.—The city council is considering the erection of a bridge over the Mississippi river at Nineteenth street and plans to issue $500,000 in bonds to meet the expense. F. W. Cappelen is city engineer.

KANSAS CITY, MO.—The Wall Frogless Switch & Mfg. Co. has broken ground for its proposed $100,000 plant which it expects to have in operation this spring.

KANSAS CITY, MO.—The city of Kansas City will build a viaduct at Twenty-seventh street costing $100,000, on which bids will be received until Jan. 23. It will contain six 37-foot spans and one 110-foot arch span with 40-foot roadway. Hedrick & Hedrick, Kansas City, are the engineers.

ST. LOUIS.—The Jackes-Evans Mfg. Co., Main and Tyler streets, has obtained plans for a factory to cost $100,000.

ST. LOUIS.—The Aetna Spring & Ring Co. has been incorporated to manufacture motor vehicles and accessories with $12,000 capital stock by S. E. Ellman, M. A. Jenkins and J. F. Jenkins.

BOONE, IA.—Boone county plans to build a 60-foot pony truss bridge and a 70-foot skew pony truss bridge. J. A. Illeman, of Boone, is county engineer.

CHARITON, IA.—J. W. Merser, county engineer, is preparing plans for a 40-foot and an 80-foot pony-truss span and for 20-foot, 24-foot and 30-foot I-beam bridges.

CHEROKEE, IA. — Plans are being prepared by J. F. Chapman, county engineer, for two 70-foot, a 65-foot, 45-foot and 40-foot pony-truss bridge and a 45-foot skew pony truss bridge.

CLINTON, IA.—J. C. Thorne, city engineer, is making plans for a new steam pumping plant at the city waterworks.

DUBUQUE, IA.—The Farley & Loetscher Mfg. Co. plans to build a 7-story factory 100 x 256 feet.

HUMBOLDT, IA. — Humboldt county is making plans for a 65-foot and 70-foot pony truss bridge. L. D. Snyder, of Dakotah, is county engineer.

MANCHESTER, IA. — The National Mfg. Co. has been incorporated to manufacture farm implements and steel gates with $50,000 capital by H. M. Bradley, A. M. Cloud and C. G. Yoran.

MARSHALLTOWN, IA. — The La Plant Co., manufacturer of furnaces, will build a 2-story foundry addition 60 x 90 feet, costing $6,000. C. H. Jones is president.

NEWTON, IA.—The E. J. Miles Co. will build a machine shop 66 x 132 feet, costing $10,000.

PRIMGHAR, IA.—J. C. Kerrigan, county engineer, is preparing plans for a 65-foot, 50-foot and 40-foot pony-truss span and several I-beam bridges.

ROCKWELL CITY, IA.—W. E. McClure, county engineer, is preparing plans for a steel bridge consisting of two 100-foot spans.

South of Mason-Dixon Line

NORFOLK, VA.—The Southern Transportation Co., operating a line of barges and tugs between Charleston, Philadelphia, New York and other places, immediately will begin the erection of a $200,000 plant for the construction and repairing of barges, tugs and other vessels here. The new yard at Norfolk will be in addition to the ship yard the company now maintains at Chesapeake City, Md. The headquarters of the company are at Philadelphia.

CHATTANOOGA, TENN.—A 5-story concrete garage and storage building to cost $50,000, will be erected on Georgia avenue by Mims Hightower and others.

MEMPHIS, TENN.—The Continental Piston Ring Co. has increased its capital to $1,000,000 and proposes expansion of its business. W. P. McCadden is president.

VINTON, LA.—Bids will be received about April 1 for a waterworks system including a 500-gallon power driven pump and a 50,000-gallon tank on a 100-foot tower, costing about $25,000. T. H. Mandell, Lake Charles, is engineer.

Mississippi to the Rockies

MUSKOGEE, OKLA.—The Hall Foundry & Mfg. Co. has been incorporated with $50,000 capital by J. T. Davis, Muskogee, C. E. Hall, Muskogee and W. L. McClellan, Little Rock, Ark.

SHAWNEE, OKLA.—The Shawnee Ice Machine Co. has been incorporated with $60,000 capital by W. T. Williams, John R. Pring and L. V. Leachman.

SALT LAKE CITY, UTAH.—The Aultman & Taylor Machinery Co., Mansfield, O., has opened a branch in this city and plans to erect a $25,000 building.

COLORADO SPRINGS.—An election will be held soon on issuing $500,000 in bonds for a waterworks system. G. P. Anderson, of Los Angeles, is engineer.

TRINIDAD, COL.—The city of Trinidad has sold $28,000 worth of bonds for a waterworks system. W. R. Lewis is superintendent.

LITTLE ROCK, ARK.—The city of Little Rock plans to build a steel bridge 1,743 feet long costing $300,000. Moorehead Wright is chairman of the commissioners.

The Dominion of Canada

SHERBROOKE, QUE.—H. C. King, purchasing department, city hall, Sherbrooke, is in the market for a vertical steam boiler of 10 horsepower.

ST. JOHNS, QUE.—The Dominion Crucible Co. will build a plant at St. Johns and will purchase machinery for the plant.

COBOURG, ONT.—The Federal Steel & Foundry Co. will build a steel plant and rolling mill at Cobourg. J. H. Cole, the Corbett Foundry & Machine Co., Owen Sound, Ont., is manager.

NEW TORONTO, ONT.—Brown's Copper & Brass Rolling Mills will build a new wire mill and other buildings at its plant at New Toronto.

TORONTO, — The Chapman Double Ball Bearing Co. will build an addition to its plant at a cost of $18,000.

WINGHAM, ONT.—The Western Foundry Co. will build an addition to its plant estimated to cost $15,000. Construction work will be started next spring.

ANYOX, B. C.—Granby Co. is preparing to make improvements including an additional converter and two furnaces.

VICTORIA, B. C. — The Aetna Iron & Steel Co., Ltd., will build a large steel plant at Victoria.

VICTORIA, B. C.—New York capitalists have purchased the Ladysmith smelter formerly operated by the Tyee Copper Co. Improvements and extensions costing $100,000 will be made.

The Pacific Coast States

INDEX, WASH. — G. N. Miller, Burke building, Seattle, will prepare plans for a municipal light plant at this place. Water is to be taken from Deer creek and carried two miles in a municipal pipe line. Bonds will be issued.

LEAVENWORTH, WASH.—It is reported work will be started shortly by the Great Northern railroad on its Lake Chelan power plant. The project calls for 120,000 horsepower and will cost about $5,000,000.

SEATTLE.—The Northern Pacific railroad has awarded a contract for machine shop and blacksmith shop at Hanford and Occidental streets, costing $150,000.

SEATTLE.—The Seattle Renton & Southern railroad will spend about $150,000 in laying new track, constructing bridges, etc., during the year.

SEATTLE. — Charles E. Fawler, engineer, Central building, is preparing plans for a plate girder bridge over the Lake Washington canal for the Puget Sound Traction, Light & Power Co.

SEATTLE.—An election will be held March 6 on the issuing of $275,000 in bonds for a steel and reinforced concrete bridge over the Lake Washington canal and $450,000 in bonds for a steel bascule bridge on West Waterway. A. H. Dimock is city engineer.

PORTLAND, ORE.—Plans are being made by Houghtaling & Dougan, 508 Henry building, for the Benson hotel, 7 stories, 100 x 100 feet, built to carry 13 stories.

PORTLAND, ORE.—Plans are being made by Houghtaling & Dougan, 508 Henry building, for the Benson hotel, 7 stories, 100 x 100 feet, built to carry 13 stories.

PORTLAND, ORE.—City purchasing agent is authorized to invite bids for furnishing the city with 50 tons of 6-inch pipe; 30 tons of 10-inch pipe; 70 tons of 16-inch pipe and 100 tons of pipe of various sizes with sleeves, couplings, etc.

LOS ANGELES.—The city will build a 1-story machine shop, 40 x 156 feet, at 217 San Fernando street.

LOS ANGELES.—The Llewellyn Iron Works will build two machine shop buildings, 50 x 125 feet and 50 x 250 feet, to replace others recently burned.

LOS ANGELES. — The Mowry Machinery Co. has been incorporated with $500,000 capital by S. F. Mowry, L. Bulkley and S. A. Markwell.

OAKLAND, CAL.—The East Bay Foundry Co., William Cobb, president, has nearly completed its new plant at Chestnut and Thirty-second streets.

STOCKTON, CAL.—The Holt Mfg. Co. is building a machine shop 100 x 300 feet.

TORRANCE, CAL. — The Pacific Electric Railroad of Los Angeles, will start work early in the spring on new shops of brick, steel and concrete, including a paint and machine shop, each 180 x 450 feet, freight car shop 180 x 400 feet, blacksmith shop, 155 x 200 feet and powerhouse 60 x 120 feet. J. D. Isaacs of New York City, is engineer.

TORRANCE, CAL.—The Pacific Electric Railroad of Los Angeles will start work early in the spring on new shops of brick, steel and concrete, including a paint and machine shop, each 180 x 450 feet; freight car shop, 180 x 400 feet; blacksmith shop, 155 x 200 feet, and powerhouse, 60 x 120 feet. J. D. Isaacs, of New York City, is engineer.

New Catalogs

ENGINE LATHES.—In a well-illustrated catalog entitled G-K Betterments the Greaves-Klusman Tool Co., Cincinnati, bring to the attention of the machine tool user the improvements which have been made in Greaves-Klusman products. The various types of lathes manufactured by this concern are shown in full-page cuts, accompanied by brief descriptions of the tools shown. The details of construction such as the headstock, carriage, cross-feeds and drives are fully described and well illustrated. A table of all the dimensions of both the geared head and heavy cone head lathes is given on the last page of the catalog.

CORKBOARD INSULATION. — A folder considering corkboard insulation on brine lines has been published by the Armstrong Cork & Insulation Co., Pittsburgh. Several examples of corkboard durability are cited in which the insulation lasted fifteen years. When stripped off at the end of that period, it was found to be in such good condition that it was decided to utilize it on other brine lines. Cork covering employed on ammonia and ice water lines on accumulators, coolers, tanks, etc., is described.

IRON AND STEEL PRICES

Corrected up to Tuesday noon

PIG IRON

Bessemer valley	$35.00
Bessemer, Pittsburgh	35.95
Basic, Pittsburgh	30.95
Basic, eastern Pa.	30.50 to 31.00
Basic, Buffalo	35.00
Malleable, Pittsburgh	31.95 to 33.95
Malleable foundry, Chicago	30.00 to 31.00
Malleable foundry, Philadelphia	32.00 to 33.00
Malleable foundry, Buffalo	35.00
No. 1X foundry, Philadelphia	31.00 to 31.50
No. 2 foundry, Pittsburgh	31.95 to 33.95
No. 2 foundry, Cleveland	30.30 to 31.30
No. 2 foundry, Ironton	30.00
No. 2 foundry, Chicago	30.00 to 31.00
No. 2X foundry, Philadelphia	30.00 to 31.00
No. 2X foundry, N. J. tidewater	30.00 to 31.00
No. 2X foundry, Buffalo	35.00
No. 2 plain, Philadelphia	29.50 to 30.00
No. 2 plain, N. J. tidewater	29.50 to 30.00
No. 2 plain, Buffalo	35.00
No. 2 southern, Birmingham	23.00 to 25.00
No. 2 southern, Cincinnati	25.90 to 27.90
No. 2 southern, Chicago	27.50 to 28.00
No. 2 southern, Phila. deilvery	28.00 to 30.00
No. 2 southern, Cleveland	27.50 to 29.00
No. 2 southern, New York docks	28.25 to 30.25
No. 2 southern, Boston docks	28.00 to 30.00
No. 2 south. interior, New Eng.	29.00 to 31.00
No. 2 southern, St. Louis	
Virginia, No. 2X furnace	27.00 to 28.00
Virginia, No. 2X, Philadelphia	29.75 to 30.75
Virginia, No. 2X, Jersey City	30.00 to 31.00
Virginia, 2X, Boston points	30.25 to 31.25
Gray forge, eastern Pa.	29.00 to 29.50
Gray forge, Pittsburgh	30.95
Gray forge, Birmingham	22.00
Silveries, 8 per cent, furnace	36.00 to 37.00
Silveries, 8 per cent, Chicago	38.50
Low phos. Standard, Phila	55.00 to 57.00
Low phos. Lebanon, Pa., furnace	50.00 to 55.00
Low phos., Pittsburgh	50.00 to 51.00
Charcoal, Lake Superior, Chgo., Nos. 1 to 4	33.75 to 34.75
Charcoal, Buffalo	24.00 to 27.00
Charcoal, Birmingham	26.00 to 27.00

IRON ORE

Lake Superior Ores.
(Lower Lake Ports.)

Old range Bessemer, 55 per cent, ton	5.95
Mesabi Bessemer, 55 per cent, ton	5.70
Old range non-Bes., 51½ per cent, ton	5.20
Mesabi non-Bess., 51½ per cent, ton	5.05

Port Henry Ores.
(Per unit delivered eastern Pa.)
(All non-Bessemer.)

Old Bed, crude, 58 per cent	10.50c to 11.00c
Old Bed, concent., 65 per cent.	11.00c to 11.50c
Harmony concent., 63 per cent.	11.50c to 11.75c
Lump (at mines)	$5.75

Foreign Ores.
(Per unit, Philadelphia.)

Foreign Bess., 50 to 65 per cent	nominal
For'n non-Bess., 50 to 65 per cent	nominal

COKE

(At the ovens.)

Connellsville furnace	$9.00 to 9.50
Connellsville furnace, contract	8.00
Connellsville foundry, contract	6.50 to 6.75
Connellsville foundry	10.00 to 11.00
Wise county furnace, contract	5.00 to 5.50
Wise county foundry, contract	6.50 to 7.50
Pocahontas foundry, contract	6.00 to 7.50
Pocahontas furnace, contract	5.00 to 5.50
New River foundry, contract	6.25 to 7.75
New River furnace, contract	5.25 to 5.75

FERRO ALLOYS AND STEEL MAKING METALS

Ferro manganese, 80 per cent, seaboard, or furnace prompt	$175
Ferro manganese, 80 per cent, seaboard, or delivered, contract	164 to 175
Spiegel, 20 per cent, fur. early and last half	55.00 to 60.00
Ferro-silicon, 50 per cent, Pbgh.	$150.00

Bessemer ferro-silicon, 9 per cent to 10 per cent, $4100; 10 to 11 per cent, $42.00; 11 to 12 per cent, $43.00; 12 to 13 per cent, $44.00 a ton at the furnace at Ashland, Jackson and New Straitsville, O.

Ferro-carbon titanium, 8 to 12½ cents per pound in carloads.

SEMI-FINISHED MATERIAL

Open hearth billets, Phila	$60.00 to 65.00
Forging billets, Phila.	75.00 to 85.00
Forging billets, Pbgh., nominal	75.00 to 85.00
Forging billets, Chicago	70.00
Wire rods, Pittsburgh	75.00 to 80.00
Bessemer billets, Youngstown	60.00 to 65.00
Bessemer billets, Pittsburgh	60.00 to 65.00
Open hearth billets, Pittsburgh	60.00 to 65.00
Open hearth billets, Youngstown	60.00 to 65.00
Bess. sheet bars, Youngstown	60.00 to 65.00
Op. h'th sheet bars, Youngstown	60.00 to 65.00
Bess. sheet bars, Pittsburgh	60.00 to 65.00
Open hearth sheet bars, Pbgh.	60.00 to 65.00
Muck bars, Pittsburgh (nominal)	50.00
Grooved steel skelp	3.00c to 3.10c
Sheared steel skelp	3.50c to 3.60c

RAILS AND TRACK MATERIAL

(Gross tons.)

Stand. Bess. rails, Pbgh. & Chgo.	$38.00
Stan. op-h'th rails, Pbgh. & Chgo.	40.00
Light rails, 8 to 10 lbs., Pbgh.	53.00
Light rails, 8 lb., Chicago	49.00
Light rails, 12 to 14 lbs., Pbgh.	52.00
Light rails, 12 lbs., Chicago	47.00
Light rails, 16 to 20 lbs., Pbgh.	51.00

Freight Rates, Pig Iron

Mahoning and Shenango valleys to:—	
Cleveland	$0.95
Newark, N. J.	2.98
Boston	3.18
Philadelphia	2.78
Pittsburgh	.95
St. Louis	3.18
Buffalo to:—	
Albany, N. Y.	$1.26
New England (all rail)	2.58
New York and Brooklyn (all rail)	2.58
New York ad Brooklyn (by canal)	1.25 to 1.60
Virginia furnaces to:—	
Boston docks (r. and w.)	$3.05
New England (all rail)	3.25
New York dock (r. and w.)	2.88
Birmingham, Ala., to:—	
Cincinnati	$2.90
Chicago	4.00
Cleveland	4.00
Louisville, Ky.	2.65
New York (all rail)	6.15
New York (r. and w.)	4.25
Philadelphia (all rail)	5.20
Philadelphia (r. and w.)	4.00
Pittsburgh	4.90
Savannah, Ga.	2.75
Chicago to:—	
Des Moines	$2.80
Milwaukee	.50
Moline, Ill.	1.40
Omaha	3.58
St. Louis	1.58
Ironton and Jackson, O., to:—	
Chicago	$2.54
Cincinnati	1.26
Cleveland	1.62
Detroit	1.81
Indianapolis	1.58

Light rails, 16 to 20 lbs., Chgo.	$46.00
Light rails, 25 to 45 lbs., Pbgh.	50.00
Light rails, 25 to 45 lbs., Chgo.	45.00
Relaying rails, standard, Pbgh. and Chicago	$33.00 to 34.00
Relaying rails light, Chicago	34.00 to 35.00
Angle bars, st. sect., Pbgh. base	2.25c to 2.75c
Angle bars, st. sections, Chgo.	2.25c to 2.75c
Spikes, railroad, Pittsburgh	3.40c
Spikes, railroad, Chicago	3.50c
Track bolts, Pittsburgh	4.50c to 5.00c
Track bolts, Chicago	4.25c to 4.50c
Tie plates, Chicago	$55.00 to 60.00

SHAPES, PLATES AND BARS

Structural shapes, con. Pbgh.	3.10c
Structural shapes, Pbgh.	3.10c to 3.25c
Structural shapes, Philadelphia	3.259c to 3.659c
Structural shapes, Chicago	3.19c to 3.75c
Structural shapes, New York	3.269c to 3.669c
Tank plates, Chicago	3.79c to 4.25c
Tank plates, Pittsburgh (con).	3.60c to 4.00c
Tank plates, Pittsburgh	4.50c to 5.00c
Tank plates, Philadelphia	3.909c to 4.909c
Tank plates, New York	3.919c to 4.919c
Bars, soft steel, Chicago	3.09c to 3.50c
Bars, soft steel, Pbgh. (con.)	3.00c
Bars, soft steel, Pittsburgh	3.00c to 3.25c
Bars, soft steel, New York	3.169c to 3.419c
Bars, soft steel, Philadelphia	3.159c to 3.409c
Hoops, carloads, Pbgh. contr.	3.50c
Hoops, Pbgh.	4.00c to 4.25c
Bands, Pittsburgh	3.90c to 4.10c
Bands, Pittsburgh (contr.)	3.00c
Shafting, Pbgh., contr. carloads	10 to 20 off
Bar iron, Chicago	3.00c
Bar iron, Philadelphia	3.159c
Bar iron, Cleveland	3.00c
Bar iron, New York	3.169c
Bar iron, Pittsburgh	3.25c
Hard steel bars, Chicago	3.00c

SHEETS

(In cents per pound).
(Open hearth material takes 10c above prices of bessemer.)

SHEET MILL BLACK.

Gage.	Bessemer.
17 to 21	4.30 to 5.30
22 to 24	4.35 to 5.35
25 and 26	4.40 to 5.40
27	4.45 to 5.45
28	4.50 to 5.50
29	4.55 to 5.55
30	4.65 to 5.65

TIN MILL BLACK.

Gage.	Bessemer.
15 and 16	4.30 to 5.30
17 to 21	4.35 to 5.35
22 to 24	4.40 to 5.40
25 to 27	4.45 to 5.45
28	4.50 to 5.50
29 and 30	4.55 to 5.55
30½ and 31	4.60 to 5.60

GALVANIZED.

Gage.	Bessemer.
10 and 11	5.50 to 6.50
12 to 14	5.60 to 6.60
15 and 16	5.75 to 6.75
17 to 21	5.90 to 6.90
22 to 24	6.05 to 7.05
25 and 26	6.20 to 7.20
27	6.35 to 7.35
28	6.50 to 7.50
29	6.70 to 7.70
30	6.90 to 7.90

BLUE ANNEALED.

Gage.	Bessemer.
3 to 8	4.25 to 4.75
9 to 10	4.25 to 4.75
11 to 12	4.25 to 4.75
13 and 14	4.25 to 4.75
15 and 16	4.25 to 4.75

No. 28 black, Chicago	4.69c to 4.94c
No. 28 galvanized, Chicago	6.50c to 6.75c
No. 10 blue annealed, Phila.	**4.159c to 4.659c**
No. 10 blue annealed, Chicago	4.69c to 4.94c

TIN PLATE

Tin plate, 100 lb., coke base	7.00c to 8.00c
Terne plate	5.75c

IRON AND STEEL PIPE

(Prices adopted Dec. 30, 1916.)

Steel.

Diameter in inches.	Black. Per cent off.	Galv. Per cent off.
⅛, ¼ and ⅜, butt	57	30½
½, butt	61	46½
¾ to 3, butt	64	50½
2, lap	57	44½
2½ to 6, lap	60	47½
7 to 12, lap	57	43½
13 and 14, lap	47½	....
15, lap	45	....

Iron.

Standard weight, threads and couplings, diam. in inches.	Black. Per cent off.	Galv. Per cent off.
⅛ and ¼, butt	46	19
⅜, butt	47	20
½, butt	51	33
¾ to 1½, butt	54	38
1¼, lap	40	25
1½, lap	46	32
2, lap	47	33
2½ to 6, lap	49	36
7 to 12, lap	48	35

BOILER TUBES

(Price adopted Nov. 20, 1916.)

Steel, 3½ to 4½ inches l. c. l.	46
Iron, 3½ to 4½ inches l. c. l.	36

IRON AND STEEL PRICES

Corrected up to Tuesday noon

WIRE PRODUCTS

(Adopted Nov. 24, 1916.)
(Retailers' price 5 cents above jobbers' quotations.)

Wire nails, jobbers', Pittsburgh	$3.00
Coated nails	3.00 to 3.15
Plain wire, jobbers', Pittsburgh	2.95
Galvanized wire, jobbers', Pbgh	3.65
Polished staples, Pbgh	3.15
Galvanized staples, Pbgh	3.85
Bard wire, painted, jobbers', Pbgh.	3.15
Barb wire, galv., jobbers,' Pbgh.	3.85

BOLTS AND NUTS

(Delivered within 20-cent freight radius.)

Carriage bolts, ⅜ x 6 inches, smaller or shorter, rolled thread, 40 and 10; cut threads, 40 and 2½, larger or longer, 30 and 5.

Machine bolts with hot pressed nuts ⅜ x 4 inches, smaller or shorter rolled 50; cut, 40 and 10; larger or longer, 35 and 5.

Cold pressed, semi-finished hexagon nuts, 50, 10 and 5.

Gimlet and cone point lag bolts, 50. Hot pressed square nuts, blanks, $2.50 off; tapped $2.30 off. Hot pressed hexagon nuts, blank, $2.50 off; tapped, $2.30 off.

Cold pressed square nuts, blank, $2.10 off; tapped, $1.90 off. Cold pressed hexagon nut, blank, $2.25 off; tapped, $2.00 off.

RIVETS

Structural rivets, Pbgh	4.25c
Boiler rivets, Pbgh	4.35c
Tinner's rivets, 40 and 10 off, Pittsburgh.	

STEEL SHEET PILING

(Pittsburgh.)

Base sizes	3.00c

STANDARD STEEL CHAIN

Chain, ⅜ inch proof coil	6.00c

COLD ROLLED STRIP STEEL

Base price, 7.00c per 100 pounds, hard, coils 1½ inches and wider and by .100 inch and heavier.

CAST IRON WATER PIPE

Four-inch, Chicago	$44.00 to 45.00
Six-inch and larger, Chicago	41.00 to 42.00
Six-inch Class B, New York	41.50
Four-inch Class B, New York	44.50
Four to six-inch Birmingham	39.00
Six-inch and larger, Birmingham.	36.00

Light weight water and gas pipe $1 per ton higher than standard water.

WAREHOUSE PRICES

Steel bars, Chicago	3.75c
Steel squares, 2-in. & ov., Cleve.	4.35c
Steel rounds, 2-in & ov., Cleve.	4.25c
Steel bars, und. 2 in., Cleveland.	3.85c
Steel bars, Detroit	3.70c
Steel bars, Philadelphia	3.75c
Steel bars, New York	3.85c
Steel bars, St. Louis	3.80c
Steel bars, Cincinnati	3.80c to 4.35c
Steel bars, St. Paul	3.85c
Steel bars, over 2-in., Buffalo	4.50c
Steel bars, Buffalo	3.85c
Iron bars, Chicago	3.75c
Iron bars, Cleveland	3.80c
Iron bars, Detroit	3.70c
Iron bars, St. Louis	3.75c
Iron bars, Cincinnati	3.80c to 4.35c
Iron bars, Philadelphia	3.50c
Iron bars, New York	3.70c to 3.75c
Shapes, Chicago	3.85c
Shapes, Detroit	3.90c
Shapes, St. Louis	3.90c
Shapes, St. Paul	3.95c
Shapes, New York	3.95c
Shapes, Cleveland	3.95c
Shapes, Philadelphia	3.75c
Shapes, Buffalo	3.95c
Shapes and plates, Cincinnati	3.90c to 4.60c
Plates, Chicago	4.50c
Plates, Detroit	4.75c
Plates, St. Louis	4.55c
Plates, St. Paul	4.60c
Plates, New York, wide	5.00c
Plates, New York, narrow	4.75c to 5.00c
Plates, Cleveland	4.60c
Plates, Philadelphia	4.50c to 5.00c
No. 10 blue anl. sheets, Chicago	4.65c
No. 10 blue anl. sheets, Cleve.	4.50c
No. 10 blue anl. sheets, Cleveland	4.75c
No. 10 blue anl. sheets, Buffalo.	4.50c
No. 10 blue anl. sheets, St. L.	4.70c
No. 10 blue anl. sheets, Cinci.	4.60c
No. 10 blue anl. sheets, St. Paul	4.75c
No. 10 blue anl. sheets, Detroit	4.75c
No. 28 black sheets, Chicago	5.15c
No. 28 black sheets, Cleveland	5.50c
No. 28 black sheets, Cincinnati.	4.75c
No. 28 black sheets, Detroit	5.25c
No. 28 black sheets, St. Louis	5.30c
No. 28 black sheets, St. Paul	5.25c
No. 28 galv. sheets, Chicago	7.00c
No. 28 galv. sheets, Cleveland	7.00c
No. 28 galv. sheets, Cincinnati	7.00c
No. 28 galv. sheets, Detroit	7.25c
No. 28 galv. sheets, St. Louis	7.50c
Hoops, Cleveland	4.75c
Hoops, Detroit	4.50c

Coke Oven By-Products

Spot.

Per Gallon at Producers Plant.

Pure benzol	$0.55 to .60
Toluol	1.75 to 2.00
Solvent naphtha	.25

Per Pound at Producers Plant.

Phenol	$0.50

Per 100 Pounds at Seaboard.

Sulphate of ammonia	$4.12 to 4.15

Contract.

Per Gallon at Producers Plant.

Pure benzol	$0.55 to .60
Toluol	1.50 to 1.75
Solvent naphtha	.25

Per Pound at Producers Plant.

Phenol (nominal)	$0.50

Per 100 Pounds at Seaboard.

Sulphate of ammonia	no market

IRON AND STEEL SCRAP

(Net Tons.)

Angle bars, iron, Chicago	$26.50 to 27.00
Angle bars, steel, St. Louis	19.00 to 19.50
Arch bars and transoms, St. L.	28.00 to 28.50
Arch bars and transoms, Chgo.	27.00 to 27.50
Cast, No. 1, St. Louis	15.00 to 15.50
Boiler plate, cut, No. 1, Chgo.	13.00 to 13.50
Boiler plate, cut, No. 1, St. L.	13.00 to 13.50
Boiler punchings, Chicago	20.00 to 21.00
Bundled sheet, Cincinnati	12.50 to 13.00
Busheling, No. 1, Chicago	16.50 to 17.00
Busheling, No. 1, Cincinnati	14.00 to 14.50
Busheling, No. 1, Cleveland	18.00
Busheling, No. 1, St. Louis	16.50 to 17.00
Busheling, No. 2, Chicago	12.25 to 12.75
Cast borings, Cincinnati	7.50 to 8.00
Cast borings, Cleveland	9.25 to 9.50
Cast borings, St. Louis	8.00 to 8.50
Cast borings, Chicago	8.00 to 8.50
Cast, No. 1, Chicago	15.50 to 16.00
Cast, No. 1, Cincinnati	15.50 to 16.00
Cast, No. 1, Cleveland	18.00 to 18.25
Cast, No. 1, St. Louis	15.00 to 15.50

Freight Rates, Finished Material

From Pittsburgh, carloads, per 100 lbs. to:—

New York	16.9 cents
Philadelphia	15.9 cents
Boston	18.9 cents
Buffalo	11.6 cents
Baltimore	15.4 cents
Cleveland	10.5 cents
Cincinnati	15.8 cents
Chicago	18.9 cents
Detroit	15.7 cents
Minneapolis and St. Paul	32.9 cents
Denver	83.6 cents
St. Louis	23.6 cents
New Orleans	30 cents
Birmingham	45 cents
Pacific coast (all rail)	73.9 cents
Pacific coast (tin plate)	70 cents
Pacific coast, via Panama canal	61.9 cents

Cut forge, Chicago	22.00 to 22.50
Grate bars, Cleveland	12.00 to 12.50
Iron axles, St. Louis	36.50 to 37.00
Iron axles, Cleveland	44.00 to 45.00
Knuckles, coup., Chicago	23.00 to 23.50
Knuckles, coup., St. Louis	23.50 to 24.00
Locomotive tires, Chicago	29.00 to 29.50
Locomotive tires, St. Louis	26.00 to 26.50
Machine shop turnings, Chicago	9.00 to 9.50
Machine shop turnings, Cleveland	9.00 to 9.25
Machine shop turn'gs, Cincinnati	7.00 to 7.50
Machine shop turnings, St. Louis	9.50 to 10.00
Malleable agricultural, Chicago	15.00 to 15.50
Malleable agricultural, St. Louis	16.00 to 16.50
Malleable, Cincinnati	12.50 to 13.00
Malleable railroad, Chicago	17.50 to 18.00
Malleable railroad, St. Louis	16.50 to 17.00
Pipes and flues, Cleveland	15.00 to 15.75
Pipes and flues, Chicago	13.50 to 14.00
Pipes and flues, St. Louis	14.00 to 14.50
Railroad wrought, No. 1, Cleve.	25.00 to 25.50
Railroad wrought, No. 1, Chgo.	23.00 to 23.50
Railroad wrought, No. 1, Cinci.	19.00 to 20.00
Railroad wrought, No. 1, St. L.	22.50 to 23.00
Railroad wrought, No. 2, Chgo.	22.00 to 22.50
Railroad wrought, No. 2, St. L.	22.00 to 22.50
Shafting, St. Louis	24.50 to 25.00
Springs, Chicago	24.00 to 24.50
Steel car axles, St. Louis	38.00 to 38.50
Steel car axles, Chgo	35.00 to 36.00
Stove plate, Chicago	11.00 to 11.50
Stove plate, Cleveland	12.25 to 12.75
Stove plate, Cincinnati	10.50 to 11.00
Stove plate, St. Louis	12.00 to 12.50

(Gross Tons.)

Axle turnings, Cleveland	$16.50 to 16.75
Axle turnings, Buffalo	17.50 to 18.00
Busheling, No. 1, Buffalo	21.50 to 22.00
Busheling, No. 1, Pittsburgh	16.50 to 17.25
Busheling, No. 2, Buffalo	15.00 to 15.50
Bundled sheets, Pittsburgh	16.00 to 16.50
Bundled sheets, Cleveland	14.50 to 15.00
Bundled sheets, Buffalo	15.00 to 16.00
Bundled tin, Buffalo	15.00 to 16.00
Car wheels, (iron), Pittsburgh	21.00 to 22.00
Car wheels, (steel), Pittsburgh	27.00 to 28.00
Car wheels, Chicago	19.00 to 19.50
Car wheels, eastern Pa	21.00 to 22.00
Car wheels, Buffalo	23.00 to 24.00
Car wheels, New York	19.00 to 20.00
Car wheels, St. Louis	21.50 to 22.00
Car wheels, Birmingham	18.00 to 19.00
Car wheels, Cleveland	19.00 to 19.50
Tram car wheels, Birmingham	16.00 to 17.00
Cast borings, New York	11.50 to 12.00
Cast borings, eastern Pa	13.50 to 14.00
Cast borings, Buffalo	11.50 to 12.00
Cast borings, Pittsburgh	12.00 to 12.50
Cast, No. 1, eastern Pa	20.50 to 21.00
Cast, No. 1, Pittsburgh	20.00 to 21.00
Cast, No. 1, Birmingham	19.00 to 20.00
Cast, heavy, No. 1, N. J. points	20.00 to 20.50
Forge, No. 1, eastern Pa	15.00 to 15.50
Frogs, switches, guards, St. L.	21.50 to 22.00
Grate bars, Buffalo	15.50 to 16.00
Grate bars, N. J. points	15.00 to 15.50
Heavy axle turnings, Buffalo	15.00 to 15.50
Heavy melting steel, Pittsburgh	22.00 to 23.00
Heavy melting steel, Buffalo	26.00 to 27.00
Heavy melting steel, Chgo	20.50 to 21.00
Heavy melting steel, Cleveland	22.00 to 22.50
Heavy melting steel, Cincinnati	19.00 to 20.00
Heavy melting steel, eastern Pa.	21.00 to 22.00
Heavy melting steel, New York	19.00 to 20.00
Heavy melting steel, St. L	22.00 to 22.50
Heavy melting steel, Birmingham	20.00 to 21.00
Hydraulic pressed sheet, Cleveland	17.50 to 18.00
Hydraulic pressed sheets, Pbgh.	18.00 to 18.50
Hydraulic pressed sheets, Chgo.	14.50 to 15.00
Iron rails, Chicago	27.50 to 28.00
Iron rails, Buffalo	25.00 to 26.00
Iron rails, Cincinnati	24.00 to 25.00
Iron rails, St. Louis	27.00 to 27.50
Iron rails, Cleveland	29.00
Iron axles, Pittsburgh	39.00 to 40.00
Iron axles, Cincinnati	40.00 to 41.00
Iron axles, eastern Pa	38.00 to 40.00
Iron axles, Chicago	42.50 to 43.50
Iron axles, Buffalo	45.00
Low phos. steel, Buffalo	32.00 to 34.00
Low phos. steel, Pittsburgh	31.00 to 35.00
Low phos. steel, eastern Pa	32.00 to 34.00
Machine shop turnings, Buffalo	11.50 to 12.00
Mch. shop turnings, New York	11.00 to 11.50
Mch. shop turnings, Pittsburgh	11.75 to 12.25
Mch. shop turnings, eastern Pa.	13.00 to 13.50
Mch. shop turnings, Birmingham	10.00 to 11.00
Malleable railroad, Cleveland	20.50 to 21.00
Malleable railroad, Buffalo	23.00 to 24.00
Malleable railroad, Pittsburgh	21.00 to 21.50
Malleable railroad, eastern Pa.	17.00 to 18.00
R. R. and mch. cast, No. 1, Bfl.	23.00 to 24.00
R. R. wrought, No. 1, Buffalo	30.00 to 31.00
R. R. wrgt., No. 1, eastern Pa.	26.50 to 27.50
City wrought, New York	21.25 to 21.50
R. R. wrought, No. 1, Pbgh	24.00 to 24.50
R. R. wrought, No. 1, B'ham	20.00 to 21.00
Reroll. rails, 5 ft. & ov., Pbgh.	31.00
Reroll. rails, 5 ft. & ov., Chgo.	26.50 to 27.00
Reroll. rails, 5 ft. & ov., E. Pa.	27.00 to 28.00
Reroll. rails, 5 ft. & ov., St. L.	27.50 to 28.00
Shafting, New York	24.50 to 25.00
Shafting eastern Pa	27.00 to 28.00
Shoveling steel, Chgo	18.00 to 18.50
Shoveling steel, St. Louis	19.00 to 19.50
Steel rails, short, Chicago	23.50 to 24.00
Steel rails, short, Cleveland	23.50 to 24.00
Steel rails, over 6 ft., Cleveland.	21.00 to 22.00
Steel rails, old, Birmingham	20.00 to 21.00
Steel rails, short, St. Louis	26.00 to 26.50
Steel car axles, Birmingham	35.00 to 36.00
Steel car axles, New York	38.00 to 40.00
Steel car axles, Buffalo	45.00
Steel car axles, Cleveland	49.00 to 50.00
Steel car axles, Pittsburgh	39.00 to 40.00
Steel car axles, eastern Pa	38.00 to 40.00
Stove plate, N. J. points	15.00 to 15.50
Stove plate, Birmingham	12.50 to 13.50
Stove plate, Buffalo	16.00 to 16.50
Stove plate, eastern Pa	16.00 to 17.00
Stove plate, Pittsburgh	13.00 to 14.00
Wrought pipe, Buffalo	17.00 to 17.50
Wrought pipe, eastern Pa	17.00 to 18.00
Wrought pipe, New York	16.00 to 17.00

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Pittsburgh Valve Foundry & Const. Co., Pittsburgh, Pa.
Swedish Crucible Steel Co., Detroit, Mich.
United Engrg. & Foundry Co., Pittsburgh, Pa.
Zanesville Malleable Iron Co., Zanesville, O.

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Wah-Chang Mining & Smelting Co., New York City.

ANTIMONY OXIDES.
Wah-Chang Mining & Smelting Co., New York City.

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Lubricating Metal Co., The, New York City.
Ryerson, Jos. T., & Son, Chicago, Ill.

BAKERS, WIRE COATING.
Morgan Construction Co., Worcester, Mass.
Turner, Vaughn & Taylor Co., Cuyahoga Falls, O.

BALE TIES.
American Steel & Wire Co., Chicago, Ill.

BALLS (Steel).
Bethlehem Steel Co., The, So. Bethlehem, Pa.
New Departure Mfg. Co., Bristol, Conn.

BANDERS (Hydraulic for Projectiles).
Southwark Foundry & Mach. Co., Philadelphia.

BANDS (Steel).
Akron-Selle Co., The, Akron, O.
Carnegie Steel Co., Pittsburgh, Pa.

BARGES (Steel).
American Bridge Co., New York City.

BARRELS, TUMBLING (Wire Nails).
Turner, Vaughn & Taylor Co., Cuyahoga Falls, O.

BARS (Concrete Reinforcing).
Bourne-Fuller Co., Cleveland, O.
Carnegie Steel Co., Pittsburgh, Pa.
Cincinnati Iron & Steel Co., Cincinnati, O.
Franklin Steel Works, Franklin, Pa.
Inland Steel Co., Chicago, Ill.
Laclede Steel Co., St. Louis, Mo.
Ryerson, Jos. T., & Son, Chicago, Ill.
Trussed Concrete Steel Co., Detroit, Mich.
Upson Nut Co., Cleveland, O.
Witherow Steel Co., Pittsburgh, Pa.

BARS (Iron and Steel).
American Bridge Co., New York, N. Y.
American Iron & Steel Mfg. Co., Lebanon, Pa.
American Steel Export Co., New York City.
Belmont Iron Works, Philadelphia, Pa.
Bethlehem Steel Co., The, So. Bethlehem, Pa.
Bourne-Fuller Co., Cleveland, O.
Brown-Wales Co., Boston, Mass.
Cambria Steel Co., Philadelphia, Pa.
Camden Forge Company, Camden, N. J.
Carnegie Steel Co., Pittsburgh, Pa.
Cincinnati Iron & Steel Co., Cincinnati, O.
Franklin Steel Works, Franklin, Pa.
Harvey, Arthur C., Co., Boston, Mass.
Illinois Steel Co., Chicago, Ill.
Illinois Steel Co., Warehouse Dept., Chicago.
Illinois Steel Warehouse Co., St. Louis, Mo.
Illinois Steel Warehouse Co., St. Paul, Minn.
Inland Steel Co., Chicago, Ill.
Jones & Laughlin Steel Co., Pittsburgh, Pa.
Lackawanna Steel Co., Buffalo, N. Y.
Lockhart Iron & Steel Co., Pittsburgh, Pa.
Milton Mfg. Co., Milton, Pa.
Republic Iron & Steel Co., Youngstown, O.
Ryerson, Joseph T., & Son, Chicago, Ill.
St. Louis Screw Co., St. Louis, Mo.
Scully Steel & Iron Co., Chicago, Ill.
Standard Gauge Steel Co., Beaver Falls, Pa.
Tennessee Coal, Iron & R. R. Co., Birmingham, Ala.
Trussed Concrete Steel Co., Detroit, Mich.
United Alloys Steel Corp., The, Canton, O.
Upson Nut Co., Cleveland, O.
Westerman & Co., Lockport, N. Y.

BEAMS, CHANNELS AND ANGLES.
American Steel Export Co., New York City.
Belmont Iron Works, Philadelphia, Pa.
Bourne-Fuller Co., Cleveland, O.
Carnegie Steel Co., Pittsburgh, Pa.
Empire Art Metal Co., College Pt., N. Y.
Franklin Steel Works, Franklin, Pa.
Illinois Steel Co., Chicago, Ill.
Ryerson, Joseph T., & Son, Chicago, Ill.
Scully Steel & Iron Co., Chicago, Ill.

BEARINGS (Ball).
New Departure Mfg. Co., Bristol, Conn.

BEARINGS (Vanadium Steel).
American Vanadium Co., The, Pittsburgh, Pa.

BELT CEMENT AND DRESSING.
Graton & Knight Mfg. Co., Worcester, Mass.
Texas Company, The, New York City.

BELT LACING (Leather).
Chicago Rawhide Mfg. Co., Chicago, Ill.
Graton & Knight Mfg. Co., Worcester, Mass.

BELTING (Chain).
Link-Belt Company, Chicago, Ill.

BELTING (Leather).
Chicago Rawhide Mfg. Co., Chicago, Ill.
Graton & Knight Mfg. Co., Worcester, Mass.

BENCHES (Steel).
New Britain Mach. Co., New Britain, Conn.

BENCHES AND FRAMES (Drawing).
Morgan Construction Co., Worcester, Mass.
Turner, Vaughn & Taylor Co., The, Cuyahoga Falls, O.

BENDING AND STRAIGHTENING MACHINES.
Abramsen Engrg. Co., Pittsburgh, Pa.
Bertsch & Co., Cambridge City, Ind.
Birdsboro St'l Fdy. & Mch. Co., Birdsboro, Pa.
Cleveland Punch & Shear Works Co., Cleveland, O.
Espen-Lucas Machine Works, Philadelphia, Pa.
Hinman, D. A., & Co., Sandwich, Ill.
Lourie Mfg. Co., Springfield, Ill.
Mackintosh, Hemphill & Co., Pittsburgh, Pa.
Niles-Bement-Pond Co., New York, N. Y.
United Engrg. & Fdy. Co., Pittsburgh, Pa.

BENZOL RECOVERY PLANTS.
Koppers, H., Co., Pittsburgh, Pa.

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